

Technology Review



EDITED AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

JULY 1990

\$3.00

Images of America's Engineering Past

PLUS:

HOW TO MAKE THE BLOOD SUPPLY SAFER

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THE ENVIRONMENT, AND MORE*

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technology review

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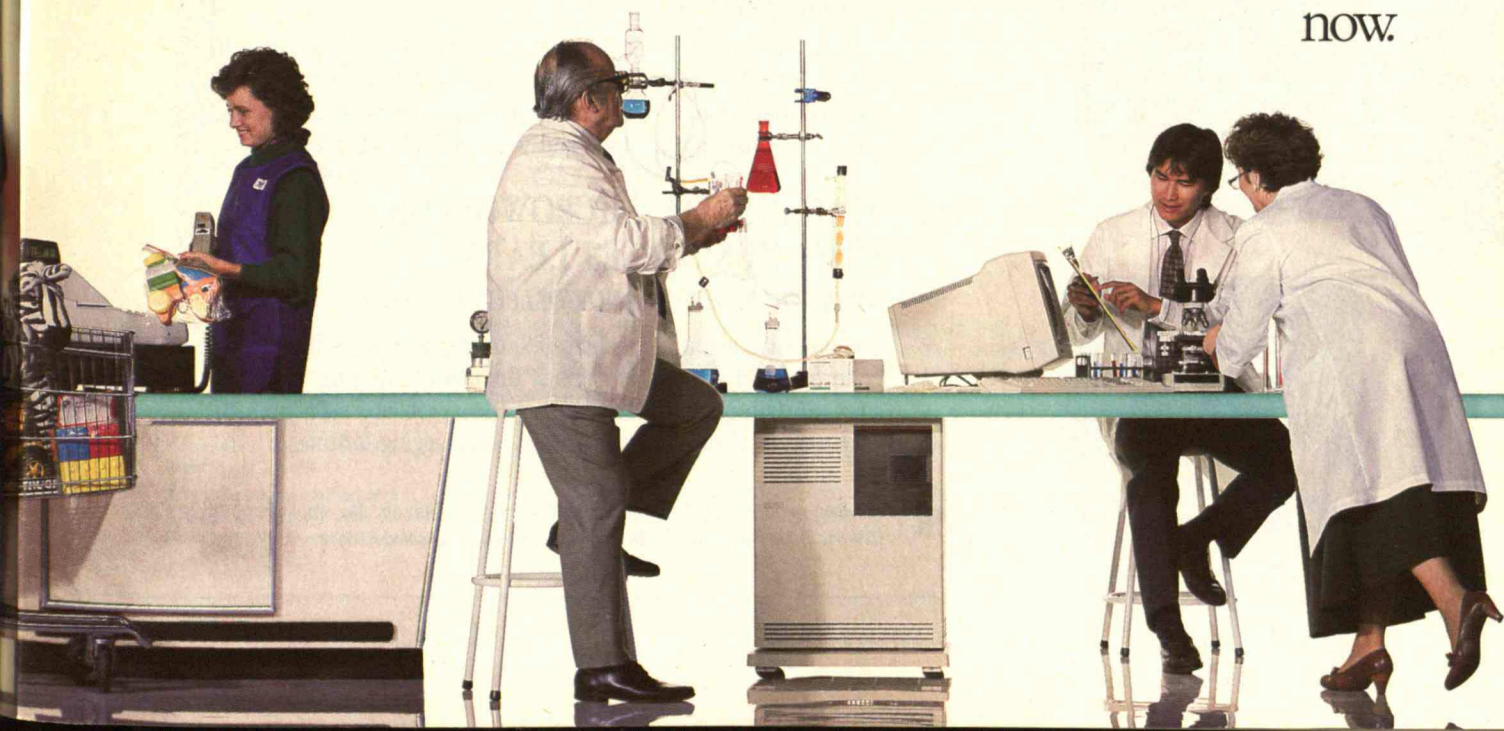
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Technology Review (ISSN 0040-1992), Reg. U.S. Patent Office, is published eight times each year (January, February/March, April, May/June, July, August/September, October, and November/December) by the Association of Alumni and Alumnae of the Massachusetts Institute of Technology. Entire contents ©1990. The editors seek diverse views, and authors' opinions do not represent official MIT policy. We welcome letters to the editor. Please address them to Letters Editor.

Editorial, circulation, and advertising offices: *Technology Review*, Building W59, MIT, Cambridge, MA 02139 (617) 253-8250. Printed by Lane Press, Burlington, VT. Second-class postage paid at Boston, MA and additional mailing offices. Postmaster: send address changes to *Technology Review*, MIT, Building W59, Cambridge, MA 02139.

Subscriptions: \$24 per year, libraries and organizations \$27. Canada add \$6, other foreign countries add \$12. Send inquiries to *Technology Review*, P.O. Box 489, Mount Morris, IL 61054

Advertising representatives: Mark E. Lynch, Eastern Sales Manager, West Ossipee, NH (603) 323-7807; The Leadership Network, 254 Fifth Ave., New York, NY 10001 (212) 684-5500; James G. Elliott Co., Los Angeles, CA (213) 746-8800; Donald Moeller, Dallas, TX 75226 (214) 559-5730; IMI Corp., Tokyo, Japan; Keith Olson/Media, Birmingham, MI (313) 642-2885; Joan Stapleton, Washington, DC (202) 331-7494.

The Volvo Syndrome

A Volvo ad in the mid-1970s claimed that half the cars the company had sold in this country were still on the road. That proportion may have changed (figures are no longer available), but the ad never told as much about the cars as about the psychology of the owners, which has remained constant.

The owners come in two types. The first type, at whom the ad was directed, can be considered rational though perhaps extravagant for buying new Volvos. They like the odometer that goes up to 999,999 miles but know full well that they will never take theirs much beyond 100,000. The second type, who made the ad true by ministering to the vehicles from there on, suffers from the Volvo syndrome. Owners of Dodge Darts or Land Rovers may also be sufferers if they have the ambition to nurse their cars forever.

I belong to this second type. I am not one of those people who maintain that cars are no longer as good as they used to be. Let me state plainly that new cars work better, get superior mileage, and pollute less. But I do see a virtue in old cars' simplicity. When they leave you stranded by the highway, you at least have a good chance of figuring out why. That does not necessarily mean you can do anything about it. Still, I find satisfaction in intellectual mastery over that exasperating necessity, my automobile, and I am always ready to roll up my sleeves and try to get the better of it.

I call my 1974 Volvo the Pumpkin, but others less charitably refer to it as the Orange Eyesore. The previous owner, a fellow syndrome sufferer, had paid dearly for it, put in a new transmission, and rebuilt the engine. He had a shop manual and all the receipts. He was asking \$1,800, but I knew a piece of junk when I saw it, so I offered him \$600. Weeks later when he came to me in desperation, I thought of shaving the price further. Why not \$300, \$200, \$100? Why not pay me to end it all? But

I took pity and gave him what I had agreed. I paid my mechanic more than I care to tally and had the pleasure of performing many other repairs myself.

The weirdest things go wrong with the Pumpkin. One time in western Massachusetts at dusk on a Sunday, every dashboard light that exists flashed on and the headlights dimmed. An apparently irrelevant piece of metal (I never did figure out where it came from) was lodged between the alternator housing and a bare stretch of the main positive wire, thus shorting out the entire charging system.

*When old
cars break down
you have the satisfaction
of figuring out why.*

As I calculate it, of seven breakdowns last year, I managed to fix five. The sixth time I phoned my mechanic, a former Volvo syndrome sufferer, who counseled me to go get a beer. I had to walk several miles each way, but that was precisely his point. It was a hot day and the fuel pump had apparently given out. By the time I returned, it was dusk, I had cooled down, the pump had cooled down, and the Orange Eyesore started right up.

Time number seven was actually a series of incidents. My spouse, Suzanne, and I had a day to go from the northeast tip of Nova Scotia to the southwest, where we hoped to catch the car ferry back to Maine. By 8:00 AM we were hearing an inauspicious vibration but couldn't locate its source. When we stopped at a trash can with a panoramic view, the engine wouldn't start. The bright sun on the sea inspired confidence, and I smugly reattached a wire that I found loose. Later, after we got gas beneath gathering clouds, I turned the key and there wasn't a sound. I grimly reattached another wire, and off we

went. I knew we were in for it. Sure enough, with headlights dimming and hysteria mounting, we rolled into a gas station 60 miles short of the ferry.

The attendant reminded Suzanne of her father, a Detroit machinist who would tear anything apart. I did not necessarily see this as a virtue. He put one of those electrical diagnostic machines on the car and discovered that the voltage coming out of the alternator was much too high. Clearly, the voltage regulator was shot, we couldn't find another within 200 miles, and without it, we'd burn the electrical system out. I mapped my plan. We would install a new battery, bypass the alternator, and start the car at dawn. Without the need for headlights, you can make 60 miles on a good battery. Of course, we'd never start the engine to get off the ferry, but I figured ferry crews must be practiced in dealing with the Volvo syndrome.

Meanwhile, Suzanne and the garage attendant had decided that the fan belt was slack. I protested that that couldn't possibly make the electrical system overcharge, but he took a crow bar to the alternator to tighten the fan belt. A geyser spouted into the air. It was dark, but you could smell radiator fluid. I felt a calm such as descends on drowning people after they give up the struggle.

"What a lousy design," I said. "Who the hell would put a radiator pipe right next to the alternator?" That's where every backyard mechanic pries to tighten the fan belt.

The garage attendant agreed. Then he took his crowbar again, jammed the copper pipe carrying radiator fluid back in place, threw in some water and \$10 worth of stuff to plug holes, tightened the fan belt—carefully—and gave us a jump start. The radiator held, the alternator charged.

That vibration had apparently shaken the alternator loose. The electrical diagnostic tool had been just plain wrong. A week later my mechanic tightened one obscure bolt and stopped the vibration. Old cars are such fun. ■

JONATHAN SCHLEFER

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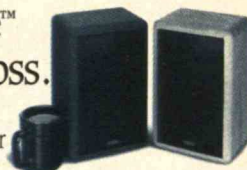
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David Clark—*Audio Magazine*

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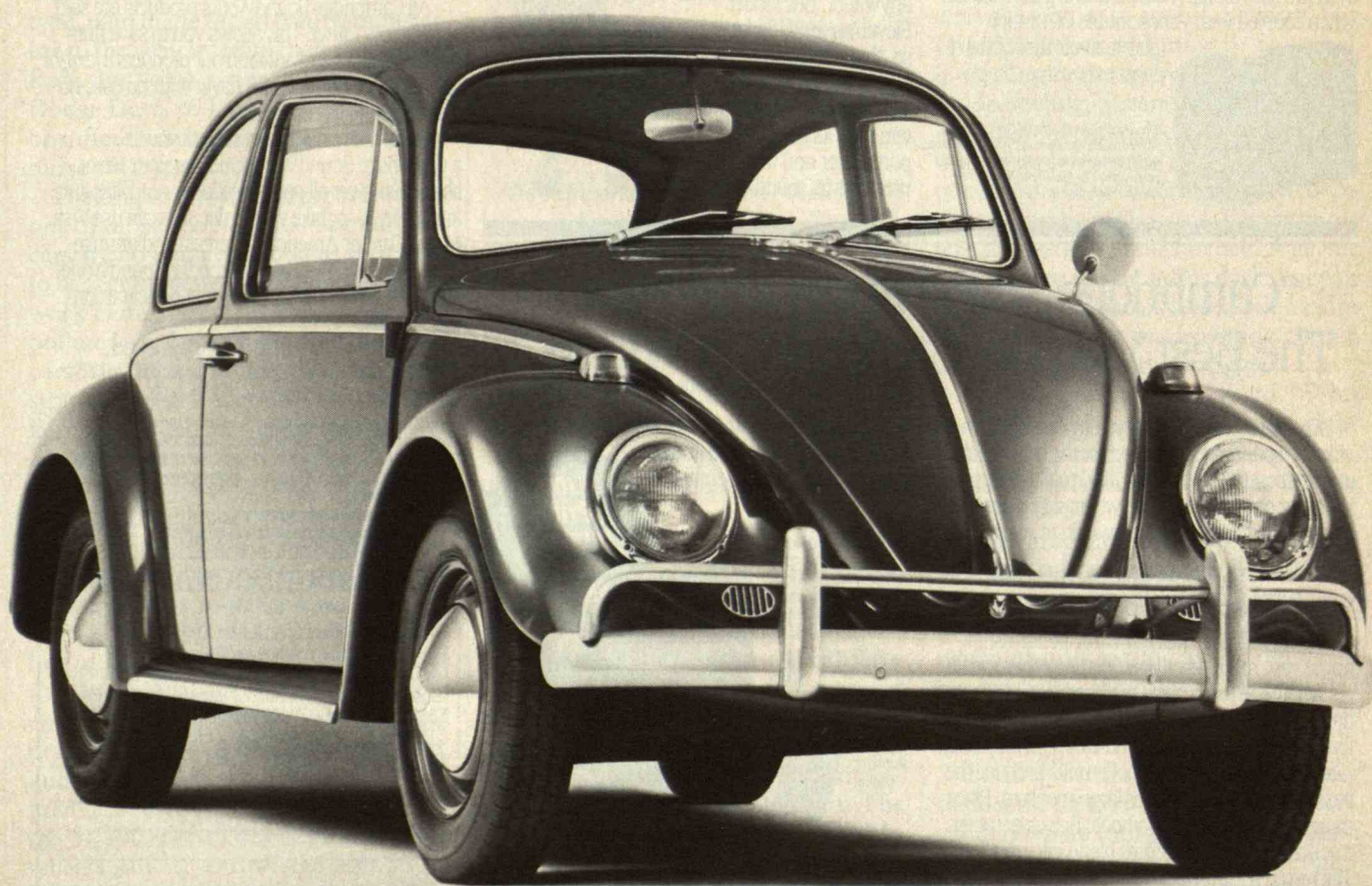
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Letters



ASPARTAME CONTROVERSY

According to "The Price of Sweetness" by Steven Farber (*TR* January 1990), "No studies show that average consumers who supplement their normal diet with aspartame either lose weight or maintain their current weight." But Mr. Farber has overlooked some important studies conducted since 1987. Our own research on obese men and women demonstrates that consuming aspartame-sweetened foods and beverages in conjunction with a sound weight-management program leads to significant weight loss with no clinically significant adverse effects.

In our first study, 59 obese free-living men and women were placed on a 12-week low-calorie diet as part of a comprehensive weight-control program that either was supplemented with aspartame-sweetened foods and beverages (for the experimental group) or was not (for the control group). Both diets were high in complex carbohydrates (49 percent) and protein (27 percent) and low in fat (24 percent); each participant attended weekly one-hour support-group sessions in which the topics for discussion included nutrition, exercise, and behavior modification. The men achieved a clinically significant weight loss in both study groups; the women lost an average of 16.5 pounds in the experimental group, compared with 12.8 pounds in the control group. A four-pound difference (30 percent) over such a short period is clinically significant. One year later, when we obtained follow-up data on 46 of the original 59 patients, we found that those who had maintained their weight loss had sustained a higher consumption of aspartame. They showed an increased level of physical activity and a decreased desire for sweets as well. Among the men there was a strong negative correlation between consuming aspartame and regaining weight.

In addition, our data do not bear out Mr. Farber's statement that "aspartame might stimulate people to want more carbohydrates and subsequently gain

weight." And in a study by another research group, in which normal-weight volunteers were given equal amounts of either low-calorie or high-calorie puddings or gelatins, all volunteers ate about the same amount at a lunch one to two hours later. Further, there were no significant differences between the groups' hunger, fullness, or desire to eat. In a similar study on the effect of consuming high- and low-calorie sweeteners on a lunch two hours later, a third team of scientists reported no difference in subjective hunger ratings or in food intake among children. However, in general, eating behavior is complex and therefore difficult to attribute to any single nutrient or substrate.

We and other investigators have supported the hypothesis that aspartame may facilitate weight loss and long-term weight control. One group gave free-living normal-weight male and female volunteers 40 ounces per day of soda sweetened with either aspartame or high-fructose corn syrup to consume as part of a normal diet. In one of the three successive three-week periods over which the study was conducted, no additional beverage was consumed. Aspartame-sweetened soda was shown to lessen calorie intake significantly (by 7 percent) and to reduce body weight slightly. Soda sweetened with high-fructose corn syrup increased calorie intake significantly (by 13 percent); body weight went up as well.

Finally, with regard to the effect of aspartame on brain chemistry, Mr. Farber has failed to recognize exhaustive experiments clearly showing that the effect of dietary amino acids on circulating amino acids is minor. The major sources of circulating amino acids, which come from the breakdown of body protein, are the ones that dominate the amino-acid pattern crossing the blood-brain barrier and thus directly affect brain chemistry and metabolism.

While we agree with Mr. Farber that aspartame by itself cannot be expected

Technology Review

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to lower body weight, food intake and body-weight regulation are complex phenomena. State-of-the-art treatment of obesity requires a multidisciplinary approach such as that described in our study of aspartame and weight control. To the extent that aspartame can help overweight people adhere to a diet, it may prove beneficial.

GEORGE L. BLACKBURN
PHILIP T. LAVIN
BEATRICE S. KANDERS
Boston, Mass.

George L. Blackburn and Philip T. Lavin are associate professors of surgery at Harvard Medical School. Beatrice S. Kanders is an instructor in surgery there.

The author responds:

Dr. Blackburn and his colleagues correctly note that there are a few studies where aspartame consumption has appeared to be effective in losing weight. However, these experiments have been performed under unnatural laboratory conditions, so the relevance to individuals who freely choose their food is, at best, unclear. In studies in more natural environments, researchers have tended, almost without exception, to conclude that aspartame is not beneficial for weight control. Furthermore, one of the pieces of evidence Dr. Blackburn cites—the one in which aspartame is substituted for high-fructose corn syrup—is not a formal, peer-reviewed study but a preliminary conference abstract.

While consumption of artificial sweeteners has increased enormously in the United States, there is little indication that Americans are getting any slimmer. In fact, an American Cancer Society survey of 78,000 women found that the rate of weight gain for aspartame users was “significantly greater” than for non-users among those who gained at least 10 pounds in a given time interval. Also, Dr. Blackburn’s own research does little to advance the argument that aspartame is useful in reducing weight. The average weight of his



female subjects was approximately 220 pounds, or between 140 and 225 percent of their ideal body weight, and although the women who received aspartame lost an average of four pounds more than those in the control group, such a difference is hardly meaningful for people who are that overweight. Moreover, Dr. Blackburn himself admits in his study that statistically the difference is not significant. He fails to note in his letter that males lost an average of four pounds more in the control group than in the aspartame group.

A number of other researchers have shown that substituting low-calorie sweeteners for sugar is an ineffective and possibly counterproductive weight-control strategy. Richard Foltin and co-workers at Johns Hopkins University School of Medicine have placed subjects on a diet that allowed them to choose the amount and type of food they ate. A baseline level of calorie intake was determined for each subject. Then, after six days, the subjects’ diets were covertly manipulated so that artificially sweetened, low-calorie items replaced a percentage of high-sugar foods. Foltin found that subjects immediately and completely compensated for the reduction of calories by eating more. He also found that after sugar was secretly returned to the diet in the last three days of the study, subjects unknowingly consumed more calories than they did at the start of the study.

As for the effect of aspartame on brain chemistry, it is unclear what “exhaustive experiments” Dr. Blackburn is referring to when he says that dietary amino acids have a minor effect on circulating amino acids. I am unaware of any experiments in which patients given either single amino acids or protein have

not had corresponding increases in levels in the blood. Lewis D. Stegink of the University of Iowa has found that administering single amino acids or a variety of protein meals can lead to a peak change in circulating amino-acid levels 26 hours after consumption. Furthermore, Timothy Mayer and Richard J. Wurtman of MIT and G. Harvey Anderson and Edmond Li of the University of Toronto have shown that consuming dietary amino acids can result in an approximate doubling of circulating amino acid levels.

Dr. Blackburn concludes by stating that “aspartame by itself cannot be expected to lower body weight.” Yet the 100 million consumers who spend millions on low-calorie products are given no indication that they need to do anything other than substitute aspartame for sugar. There is an implicit unsubstantiated claim associated with these products that consuming aspartame is useful for weight control.

ENDANGERED EARS

I agree with Alice Suter (“Noise Wars, *TR* November/December 1989) that noise is a serious problem in today’s society. I have suffered the consequences of tinnitus for 25 or 30 years and now need a hearing aid to recover the high-frequency end of the audio spectrum.

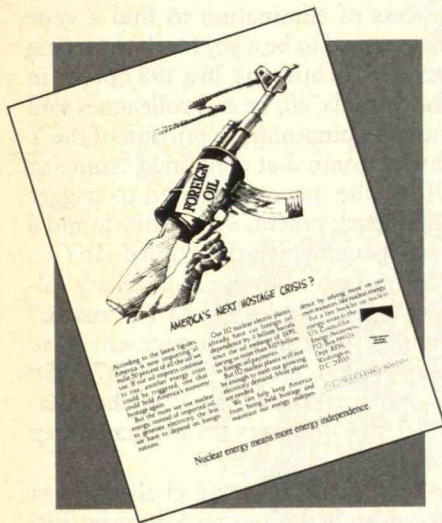
We do need to reduce work-related and other ambient noises, but I wonder why no one has done anything about the havoc that loud music wreaks on the younger generation. I have been to a couple of rock concerts and had to leave because the noise level was physically painful. I am sure the screaming and playing reaches levels of 120 decibels at such events. It must be doing permanent



damage to hearing.

I would like to see the concert promoters open performances by warning that their loud music can be harmful—just as they point out where the fire exits are. Perhaps a lawsuit claiming a hearing loss would get their attention.

CARL H. BASTIAN
Murfreesboro, Tenn.



PROPAGANDA IN ADVERTISING

I think the majority of *Technology Review* readers can fairly easily see through the hysterical propaganda in the advertisement shown here. This is only one in a series of ads the U.S. Council for Energy Awareness runs; some are overtly racist in their stereotypical characterizations of Arab people.

I believe absolutely in freedom of the press, but I see no conflict if a respected journal refuses to lend legitimacy to crude propaganda. Moreover, nuclear power, which the U.S. Council for Energy Awareness seeks to promote, is simply irresponsible. It is part of the problem of a technological society that believes in its own contradictions.

JOHN F. FLYNN
Houghton, Mich.

We, too, believe in freedom of the press, although not absolutely. The magazine's policy is to run any advertisement
Continued on page 79

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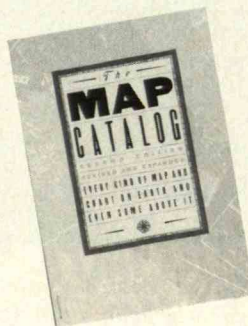
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MIT Reporter



TERMINAL BACK SEAT DRIVER

 To help drivers find their way in unfamiliar surroundings, several companies now sell computer systems with screens that show maps, and occasionally directional information. But companies don't always have enough data about road networks to develop systems for specific cities. Moreover, these aids may not tell drivers about a route's quality, and looking at details on a dashboard screen may be almost as distracting as glancing at a paper map.

A talking system could help, according to principal research scientist Christopher M. Schmandt and research associate James R. Davis of MIT's Media Laboratory. They have developed a prototype that, within a 41-square-mile range of the Boston area, gives directions based on the shortest, fastest, or simplest route.

The system, which Schmandt and Davis call the Back Seat Driver, provides detailed information down to the level of street quality. For example, the device can say, "Get in the left lane because you're going to take a left at the next set of lights. It's a complicated intersection


James R. Davis (left), a research associate, and Christopher M. Schmandt, a principal research scientist at MIT's Media Laboratory, have devised a talking navigation system. For research purposes, they use an on-board computer terminal.

because there are two streets on the left. You want the sharper of the two. It's also the better of them."

Since the Back Seat Driver considers street quality, it needs regularly updated maps of greater detail than are now being produced, says Davis. So the device probably could not be available nationally any time soon.

In the meantime, Davis and Schmandt have thorny issues to work out—such as how chatty such a system should be. Directions incorporating landmark buildings are helpful. And drivers will be reassured that the system remains functional if, during long straightaways, it gives encouraging comments or makes insignificant remarks about, say, the weather, Schmandt and Davis think. But the Back Seat Driver shouldn't nag, they observe. In other words, it shouldn't be a real back seat driver. ■

RETHINKING RESULTS ON THE GENE FRONT

 Gene-hunting tactics, some scientists have recently been reminded, are no match for that complex trickster called nature.

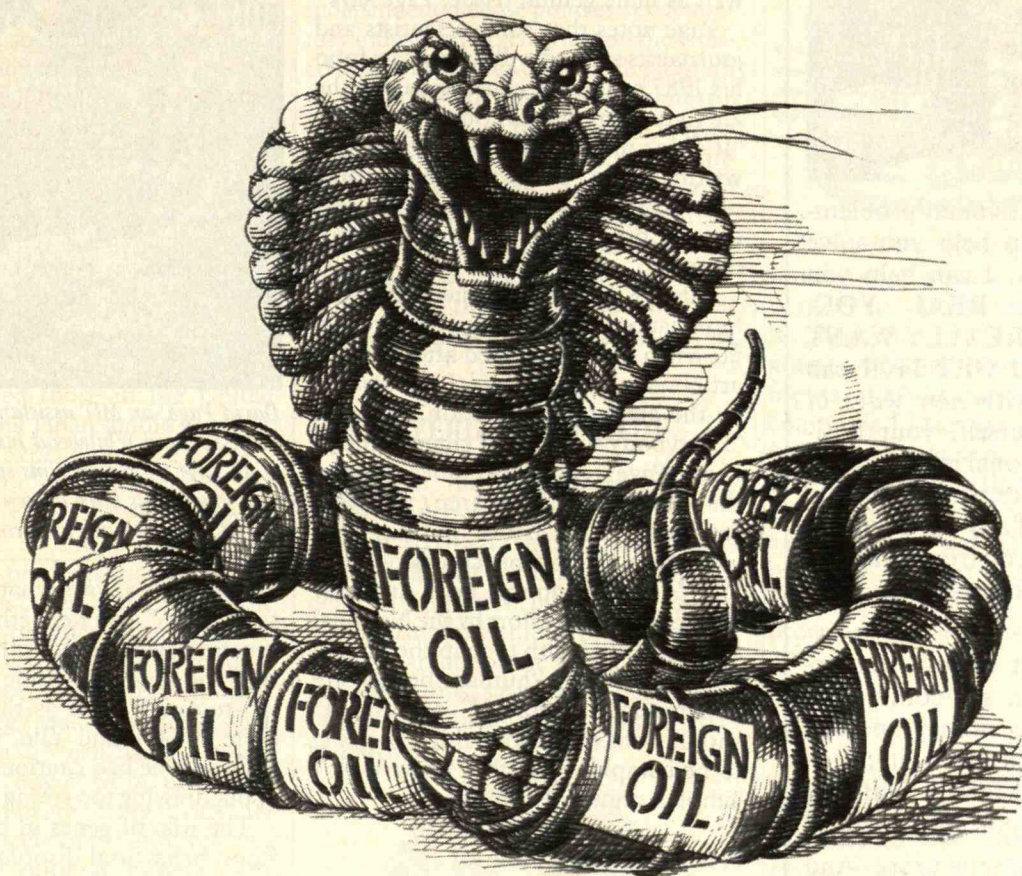
Take the example of David Page's work. Page, an MIT assistant biology professor and associate at the affiliated Whitehead Institute, used a painstaking process of elimination to find a gene that seemed to be a key for determining maleness in humans. In a 1987 paper in the journal *Cell*, he and colleagues said they had pinpointed a portion of the Y chromosome that contained "some or all" of the material needed to trigger male development. There they found a likely gene, which they called ZFY.

A barrage of national publicity followed. Scientists called ZFY a "major" finding, according to a page-one *New York Times* article. The 1987-1989 director's report of the Whitehead labeled the discovery "a dramatic step forward."

Then came a jarring challenge last December in the journal *Nature* by British researchers. They reported finding four men whose chromosomes showed no sign of the ZFY gene.

Close examination of that research has not led Page to doubt his original findings, but he thinks that the British work refines the matter. He suspects that the ZFY gene may still be a switch for maleness, but not the only one.

Page continues to think that the ZFY gene is involved because the four subjects in the British study were not as sexually unequivocal as his research subjects. Both Page and the British researchers had examined DNA from males who have two X chromosomes— anomalies, since usually people with two X chromosomes are female, while males normally have one X and one Y. In Page's XX males a fragment of one of the chromosomes seemed to have been swapped before conception with a part of a Y chromosome carrying the ZFY gene. The major sexual abnormality in such men is usually steril-



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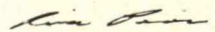
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ity. The XX males examined by the British researchers had more significant changes. One person even had female as well as male genital tissue, Page says.

Page notes that some scientists and journalists seemed willing to draw from his 1987 results the conclusion that the ZFY gene was the only one responsible. "It didn't matter how conservative our writings were," he says. "Many people now assume that there is a single sex-determining gene on the Y chromosome."

Alfred Kildow, the Whitehead's communications director, says he went too far when reporters called after the *Cell* article came out. "I think I was swayed by the amount of attention," he says. "Everybody was full of champagne."

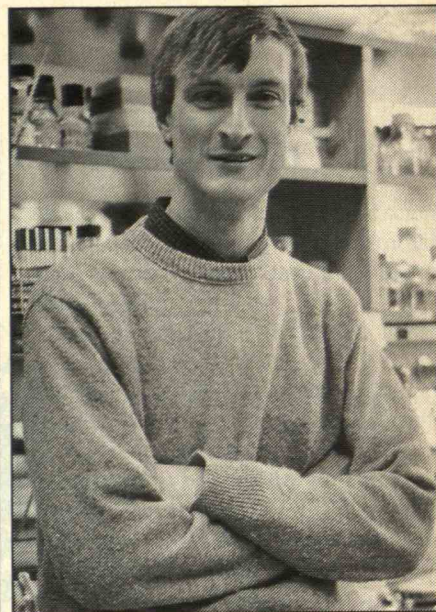
But Page's experience doesn't mean that simple hypotheses aren't worth investigating, says James Watson, who won the Nobel for his co-discovery of DNA's famous double helix and now directs the major effort by the National Institutes of Health to map the human genome. While "human beings are enormously complex," researchers should not assume something "is going to be complex until they prove it isn't simple," argues Watson.

A More Striking Reversal

Another highly publicized 1987 study that suffered a more striking reversal last November also highlights the problems with finding genes. The research involved a search for a manic-depression gene among Pennsylvania's Old Order Amish.

After tracing family connections and health records of about 100 people and analyzing DNA from a subset of 81, investigators from Yale, MIT, and the University of Miami seemed to have narrowed the location of a manic-depression gene to a part of chromosome 11. But the tie, based on statistical comparisons of illness patterns and chromosome sequences, largely evaporated after the group incorporated more Amish in the study.

"If you're a scientist, you realize that




David Page, an MIT assistant biology professor and Whitehead Institute associate, says the conclusions some scientists and journalists have drawn from his genetic research are too broad.

things aren't always what they initially seem to be," says Kenneth Kidd, a Yale geneticist who helped with the study design and analysis. While the field and lab research, such as the sequencing done at MIT and Yale, was accurate, Kidd says he had cautioned colleagues about drawing too strong a conclusion.

The role of genes in poorly understood behavioral disorders like manic depression is especially controversial. "We can define maleness and femaleness well. But there are different criteria for manic depression," says Jonathan Beckwith, a Harvard University professor of microbiology and molecular genetics. He thinks that some scientists who look for ties between genetics and complex behavior are often "jumping to conclusions before there are solid results."

Although the stories of the two studies have different endings, they both indicate the difficulties in modern genetic research, despite the advances of the past decade. "I feel that I'm getting a real lesson in both the strengths and limitations of mammalian genetics as we enter the 1990s," says Page.—MONTE BASGALL, a reporter for *The News and Observer of Raleigh, N.C.*, is a former MIT Knight journalism fellow. ■

JAPAN INCREASES ITS MILITARY SPENDING

 Japan is spending more on military products than that government's budget indicates, according to Michael W. Chinworth, director of research for MIT's Center for International Studies.

Since the 1960s the government's military budget has been, more or less, 1 percent of Japan's gross national product (GNP). This percentage has satisfied pacifists and people concerned with Japan's role in World War II, but it has bothered those in the United States who think Japan should shoulder more defense expenditures.


Based on oral commitments by the Japanese government, however, Japan's private sector is actually developing more military products than the 1 percent figure can cover, assuming all the items go into production, Chinworth says. The firms are counting on production to recoup their development costs—a strategy that makes sense since the Japanese government usually doesn't back down from unwritten agreements. Future obligations are equal to 75 percent of the government's entire annual military budget. The amount has risen for more than a decade as the Japanese Defense Agency (JDA) has focused on state-of-the-art products.

The reason such a situation has developed, Chinworth says, is that the JDA tends to pay most or all of the money due at the time of a product's delivery, rather than before, in contrast to the U.S. Defense Department's policy. Companies are apparently willing to assume the front-end cost burden in exchange for "planning security," he believes. Unlike the United States, the Japanese government does not stretch out programs to acquire a set number of goods over a longer period of time.

As a direct result of this practice, the JDA will have to increase its stated military budget in the future, reduce the number of weapons it is ordering, or

find "more creative ways to keep the system afloat," Chinworth says. The hidden expenditures will also lead to more independent defense policies and a military industry that relies less on the United States. He points out, "Each program is intended to develop a domestic weapon system to replace one currently supplied by a foreign producer, mainly the United States." The increase in production is also leading the Japanese to seek new international markets for military goods. Seen in this light, Chinworth says, "there really are a number of trade-offs for the United States." ■

COMPUTERIZING VIVALDI

 From the department of reassurances:

Every so often the computer threatens to take over another creative endeavor of humans. But programs that try to formularize music only prove the irreplaceability of the world's Mozarts and Ellingtons, says Jeanne Bamberger of MIT's Music and Theater Arts Department.




Try though they might, people cannot write computer programs good enough to produce musical works in the exact style of a composer like Johann Sebastian Bach.



To help her students better understand complex pieces of music, Bamberger has developed a computer language that lets people write programs containing the compositional elements that characterize a certain composer. Listening to the synthesized music these programs create leaves students appreciating that their "analyses fail in a very critical way," Bamberger says. There are "unique moments" in the music of a major composer, such as Vivaldi, "that cannot be reduced to a procedural generalization." ■

OUCH!

 By now most wounds from last winter's downhill ski runs have turned into war stories. Unless the heroes exaggerate, tales these days are less likely to be of leg casts than arm slings. In a study of skiing injuries last year at New Hampshire's Waterville Valley, Laurence R. Young and Shirley M. Lee found that people more often hurt their thumbs, shoulders, or heads than their lower legs.

Young, an MIT Aeronautics and Astronautics professor, and Lee, a recent graduate, attribute the decline in lower-leg injuries to improvements in ski bindings and more attention to their adjustment and testing. The study, partly funded by a bindings manufacturer, concludes that advanced skiers often ski fast enough to automatically release their bindings during spills. The trade-off: hot-doggers often "fly forward with arms extended" and hurt their upper bodies after hitting "the snow, a tree, or another skier." ■

Trends

Freedom of Information in the Computer Era

Locked in the basement of the Old Executive Office Building in Washington, D.C., a stack of magnetic computer tapes is contested terrain in a battle over the public's right to government information. Encoded on the tapes are computer messages sent among staffers in the Reagan White House after its Professional Office System (PROFS) was installed in 1986.

Three PROFS tapes provided Tower Commission investigators with vital information about the Iran-contra affair. But the rest would have been erased as a matter of course had not several public-interest groups intervened, including the American Civil Liberties Union (ACLU) and the National Security Archive, a non-profit organization that collects such documents for researchers and journalists.

A Washington court of appeals will rule soon on whether this electronic mail constitutes a bona fide government record. If the messages had been paper memos, they would legally be federal records and eligible for scrutiny under the Freedom of Information Act. But even in its most recent amendment in 1986, the act doesn't mention computers. Nor has Congress defined what it means by a "record."

The case is one of numerous legal and legislative skirmishes that are re-defining public access as the bureaucracy zooms into the age of electronic information. Even aside from PROFS-style electronic mail, the notion of a record becomes blurred as the government increasingly relies on storehouses of computerized data. In one instance, an agency successfully denied the Nader-affiliated Public Citizen Litigation Group access to data on corporate compliance with occu-

pational safety and health laws. Although computers held the information, it no longer existed in print. Fulfilling the request, the Occupational Safety and Health Administration agency contended, would have been tantamount to creating a new record and was not required by law.

The irony is that while access laws may lag, the government collects more data than ever and manipulates it with ever more sophisticated processes. A recent private accounting found that the federal government maintains more than 400 databases, ranging from census statistics to medical information. As of 1986, the Office of Technology Assessment estimated that the government had invested \$15 billion on computerized data systems. One of them, a new Securities and Exchange Commission system, should process 6 million "pages" of securities filings every year.

While all this computerization facilitates information gathering, Jerry Berman, director of the ACLU's Information Technology Project, told Congress last spring that it may also hamper public access. He warns, "In-

formation once available and published may no longer be available because it has gone down the 'black hole' of a government computer."

Programming Glasnost

A parallel debate is occurring over "transactional data"—information about how the government conducts its business. This information often takes the form of the computer programs that help the bureaucracy do its job—from allocating welfare funds to evaluating environmental hazards.

In a landmark case a decade ago, Syracuse University statistician Susan Long won access to an IRS program that determined who to audit. The program wasn't a traditional record but was obviously extremely important. And after the suit, Long detected a bias that made citizens in certain regions especially prone to suffer an audit.

To some degree, the transactional-data debate relates to the question of the government's obligation to release information in a useable form. On several occasions, courts have required agencies to make data public, while allowing them to do so in any manner. Several courts have ruled that the Central Intelligence Agency has complied with a request from the National Security Archive by releasing a four-foot-high, 5,000-page computer printout the agency itself describes as a "random-ordered data dump."

Archive deputy director Thomas Blanton thinks the case illustrates how technology can let agencies slow down—and even block—public access. Says Blanton, "If you combine the natural propensity of government bureaucracies to try to suppress po-

Documents released under the Freedom of Information Act helped expose Oliver North's shenanigans. But how much does the law apply to government data stored in computers?

tentially embarrassing information with the electronic revolution . . . it adds up to a very dangerous situation."

The Bush administration does appear to be less closed about electronic data than its predecessor, and it has stated its intention to revise electronic data guidelines to foster greater openness. Still, many believe more needs to be done, such as Rep. Robert E. Wise (D-W.Va.), who is sponsoring legislation to affirm the public's right to electronic communications.

One model being touted for federal glasnost is a new Environmental Protection Agency (EPA) database. When Congress reauthorized Superfund in 1986, it told EPA to make certain information easily available to the public. The result is the Toxic Release Inventory. For a small cost, anyone with a computer and a modem can compile all sorts of specially tailored

data. Thus, a researcher could discern the extent of pollution in a river or even the amount a specific company generates.

Still, with agencies ranging from the U.S. Patent Office to the Supreme Court planning large-scale databases, questions of access are far from settled. At the National Security Archive, Blanton maintains that the government must shed what he sees as its "tangible fear of the electronic age."

To Blanton, this will require rules about indexing and arranging electronic information. "Or else," he says, "we leave it up to the 'Oliver Norths' to determine what we will and will not know about the workings of our government." ■

SETH SHULMAN, a regular contributor to Trends, is writing a book about military toxic wastes.

Renewable Energy: Lay Your Money Down

Once the front-runner in the race to capture energy from the sun, wind, and falling water, the United States is being left in the dust, claim industry, government, and environmental experts. "We're getting outspent by the Germans and the Japanese, sometimes 10 to 1" on R&D for renewables, says Randy Swisher, executive director of the American Wind Energy Association. Already, the United States imports more wind and photovoltaic technology than it exports.

Daniel O'Neil, director of Georgia Tech's Energy and Materials Sciences Laboratory, tells a similar tale. Since U.S. investors have shown little interest in a Georgia Tech patent on a way to make oil from wood scraps, says O'Neil, the institute is discussing a technology-transfer arrangement with several European firms. "Five years from now, we'll end up buying U.S. technology back from a foreign-owned company."

"We've crippled the alternative-energy industry in this country," O'Neil thinks. "The Japanese and the Europeans have made the commitment."

Scott Sklar, executive director of the Solar Energy Industries Association, agrees: "Foreign investors take the long view. They'll buy up our struggling companies, build up their manufacturing capabilities, and in 10 or 15 years, when the U.S. market is ready, they'll walk right in."

Although the useable renewable energy resource base—solar, wind, water, geothermal, and biomass—is five to eight times greater than domestic coal reserves, renewables now supply only about 8 percent of the nation's 74 quads of annual energy demand. Taking advantage of renewables requires investment, however. One Department of Energy (DOE) projection





Luz International runs the world's largest commercial solar-power plants. Ending federal tax breaks for solar-energy investing would hurt even this billion-dollar company.

says renewables' contribution could rise modestly to 15 quads, but a second DOE study puts the figure as 90 percent of the 111 quads of national energy demand for 2010. The reason for the difference in the two estimates? The level of federal R&D spending each assumes.

Such funding dropped from \$708 million in FY81 to \$115 million in FY89, and the Bush administration has requested only \$86.6 million for FY90. A Congressional Research Service report warns, "This program would end in two to four years" if funding continued to fall at that rate.

While the numbers don't necessar-

ily signal the death of alternative-energy technology in the United States, some R&D dollars may be vanishing just when innovation has become too costly for industry to pursue on its own. "We in the United States no longer have the capacity to attract capital for high-risk ventures," says Sklar. "We need government support and policy for that."

Consider Luz International, a U.S. firm that produces 90 percent of the world's solar thermal energy. Luz has grown with almost \$1 billion from private investors. It has received no government subsidies but has benefited instead from tax breaks for in-

vestments in renewable energy. "We're big and we're healthy," claims media-relations manager Anna Lisa Erickson. But the last of those tax breaks are due to expire in September. If they aren't renewed, says Erickson, "we'll be hurting."

Peace Dividends?

Investment in hydrogen research typifies current U.S. energy priorities. Hydrogen, a clean-burning fuel created by splitting water molecules, could replace petroleum and natural gas for transportation and heating. While a \$3 million appropriation supports a small program at several universities and the DOE's Solar Energy Research Institute (SERI), the department has no hydrogen research office. Bill Hoagland, SERI's hydrogen program coordinator, observes that "two or three years ago, Germany was spending \$20 million on hydrogen research, while we were spending \$1 million."

Hydrogen is an "attractive long-term resource," says Hoagland, except that it costs more to produce than fossil fuels. But, he adds, "If we looked at damage to the atmosphere, crops, and health, [petroleum would] be more expensive."

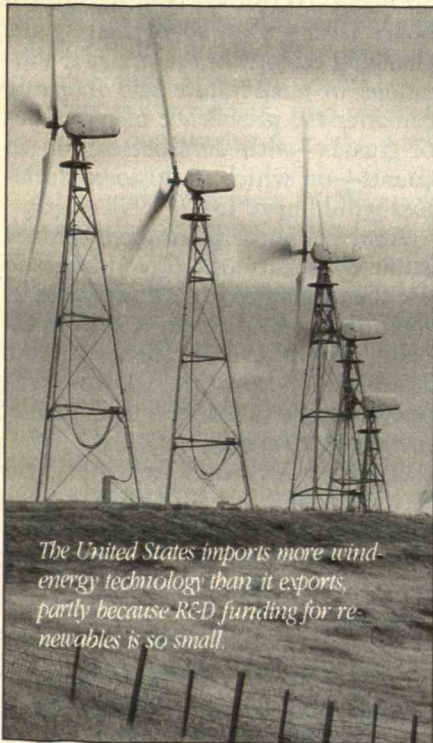
Government agencies are beginning to calculate the costs of that kind of damage. As a result, says Cathy Zoi, an environmental scientist at EPA's fledgling Global Change Division, "renewable energy is born again" at her agency.

Renewable energy may be revived through one of the oldest forms of technological support in the United States. As peace breaks out, some Pentagon research stands poised for conversion to civilian needs. For example, Air Force advances in aeronautical gas turbines, already applied with great success to commercial airlines, could lead to much more efficient gas-turbine electricity generators, notes Robert Williams, a researcher at Princeton's Center for Energy and Environmental Studies.

"Because of Air Force R&D, the United States is second to none in its aircraft-derivative turbine technology," he says. When applied to electricity generation, turbines fashioned after aircraft designs could shave capital costs and carbon emissions, run on natural gas or biomass fuels, and boost output 33 percent over the most efficient coal-fired turbine.

However, Williams laments, "nobody's doing anything about it." General Electric and Pratt-Whitney, two of the companies that developed the efficient turbines with more than \$200 million in Pentagon research funding, have declined to apply their work to turbines. "Both companies have lucrative cost-plus contracts with the Defense Department" to produce turbines for military use, he notes. "Neither has great incentive to apply this technology to a far more uncertain utility market." ■

CHRISTINA NICHOLS is a freelance writer based in Washington, D.C., specializing in energy and environmental issues.



The United States imports more wind energy technology than it exports, partly because R&D funding for renewables is so small.

Climbing the Food Chain

*So naturalists observe, a flea
hath smaller fleas that on him prey;
And these have smaller still to bite 'em;
and so proceed ad infinitum.*

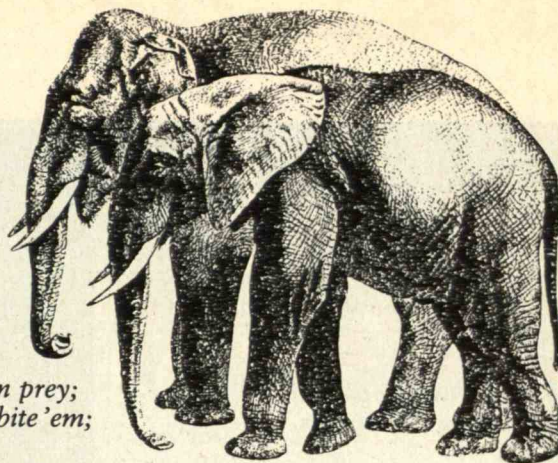
—Jonathan Swift

While most scientists would feel comfortable with the thrust of Swift's sardonic ecology, tracing the precise pathway of a food chain upward has generally proven too complex to follow with great accuracy. Now, however, the "isotopic tracking" of plant atoms is helping biologists learn how to map the connectedness of the animal kingdom.

Most atoms have several isotopes—that is, there are different numbers of neutrons in their nuclei. In carbon atoms, the most common element used for isotopic fingerprinting, this accounts for carbon-13 and carbon-14 isotopes. The variations in the numbers of neutrons usually have no significant effect on any atom's chemical activity, so both common and rare isotopes of nitrogen, oxygen, sulfur, and carbon are regularly made use of by all living things.

However, for a variety of reasons, different plants, grasses, and algae will have characteristic ratios of common and uncommon isotopes. While the variance is slight—in plants the ratio of carbon-13 to carbon-12 ranges from about 12 atoms per thousand to upwards of 28—the ratio repeats itself throughout a given food chain. In other words, plant atoms leave a distinctive chemical fingerprint that can be found in the flesh, hair, bones, fingernails, and every other body part.

For example, Donald Duggins, a researcher at the University of Washington's Friday Harbor Laboratories, and his colleagues there and at the University of California, Santa Cruz, have followed the signature of car-



"Isotopic tracking" of plant atoms could provide a way to differentiate elephant tusks culled legally in game parks from those taken by poachers elsewhere.

bon-13 in kelp beds off the Aleutian Islands. They found the kelp's trace in 11 other species in a food chain that includes mussels, fish, and cormorants.

One advantage of the isotopic fingerprinting technique is that the material needed to get a reading is minuscule. "You could get a carbon reading from one milligram," says Nikolaas Van der Merwe, a South African geochemist now at Harvard University.

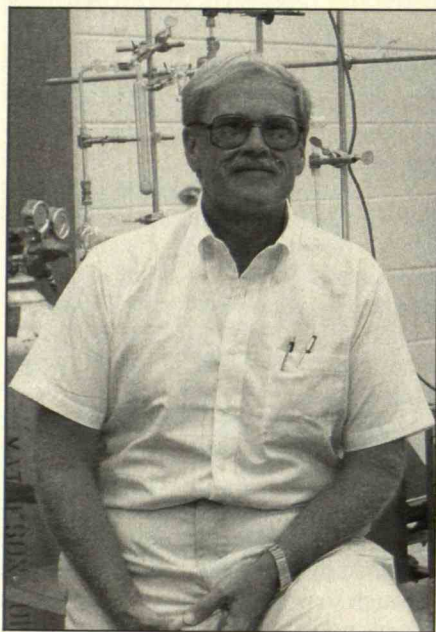
Van der Merwe has differentiated herds of African elephants from one another by means of the unique isotopic fingerprints that the atoms in their food create. He believes these chemical markings are accurate enough to provide a measure by which ivory-importing countries can differentiate tusks culled from herds in game parks from those taken by poachers elsewhere.

Van der Merwe uses three isotopic measures to differentiate elephant herds. Combining the measures gives such an accurate reading that he claims to be able to distinguish tusks from herds in two national parks in Kenya that are only about 90 miles apart. However, he concedes that if ivory-exporting nations accept his verification technique, he might have to go to a fourth isotope to accommodate all the areas in Africa where elephants live. He estimates that the

cost of such a chemical fingerprint for a pair of tusks would be in the neighborhood of \$150, trivial compared to the \$2,000 to \$5,000 poachers get for tusks.

Rhinos, Buffaloes, and Humanity's Ancestors

Geologists have used isotopic fingerprinting since the 1940s, but the relatively high cost of the mass spectrometers used to make the readings—roughly \$500,000—and their finicky nature before computerization



Isotopic fingerprints of 10,000-year-old bones help Larry Tiezen (above) study prairie ecology. Anne Katzenberg (top) sorts out the marriage practices of ancient Indians. And Nikolaas Van der Merwe (below) hopes to learn how eating habits influence evolution.

meant that biologists generally ignored them. "The field languished for quite some time because the number of people who understand the nuances was limited, and they tend to come out of geochemistry" says Henry Schwarcz, a geochemist at McMaster University in Hamilton, Ont.



As isotopic fingerprinting becomes cheaper, easier, and more widely known, biologists are discovering a host of research possibilities. At McMaster, Schwarcz and biologist/geologist Michael Risk have used the technique to answer a question about coral reefs that Darwin found profoundly paradoxical. The great English naturalist couldn't explain how coral grew in nutrient-poor water. Risk and Schwarcz have shown that Australian coral draws on nutrients

from the mainland, which is sometimes more than 60 miles away. According to Risk, this not only resolves Darwin's paradox but shows how human land uses could affect coral.

Kenneth Dunton of the University of Texas and Donald Schell of the University of Alaska at Fairbanks are tracking a chain of carbon isotopes as it works its way from microscopic water plants to polar bears. The scientists want to map where the bears—which have been known to wander 1,000 miles or more—originate from and travel to. This would allow Soviet, U.S., and Canadian wildlife officials to better manage hunts of animals within their national frontiers.

In addition to trying to develop isotopic fingerprints for other poacher-threatened species—rhinoceroses, for example—Van der Merwe is studying the skull and bones of humanity's ancestors. He hopes to find how changes in eating habits may have influenced evolution. And Larry Tiezen, a paleo-ecologist at Augustana College in South Dakota, is examining 10,000-year-old buffalo bones with a view to measuring the changing ecology of the prairies. Variations in temperature and moisture can alter the prevalence of two types of grasses—with different carbon-13 counts—on which prehistoric buffaloes would have fed.

Anne Katzenberg, an archaeologist at the University of Calgary, hopes to use the technique to sort out the marriage practices of North American Indians. She believes the bones contain a record of how often corn-eating pueblo dwellers married their mainly meat-eating neighbors. But, she notes, this pattern will only hold up if the new husband or wife died within about a decade of the marriage—after that, the isotopes from the new eating habits will have replaced the old ones. ■

STEPHEN STRAUSS, a science writer at the *Toronto Globe and Mail*, is a regular *Trends* contributor.



Quality Counts

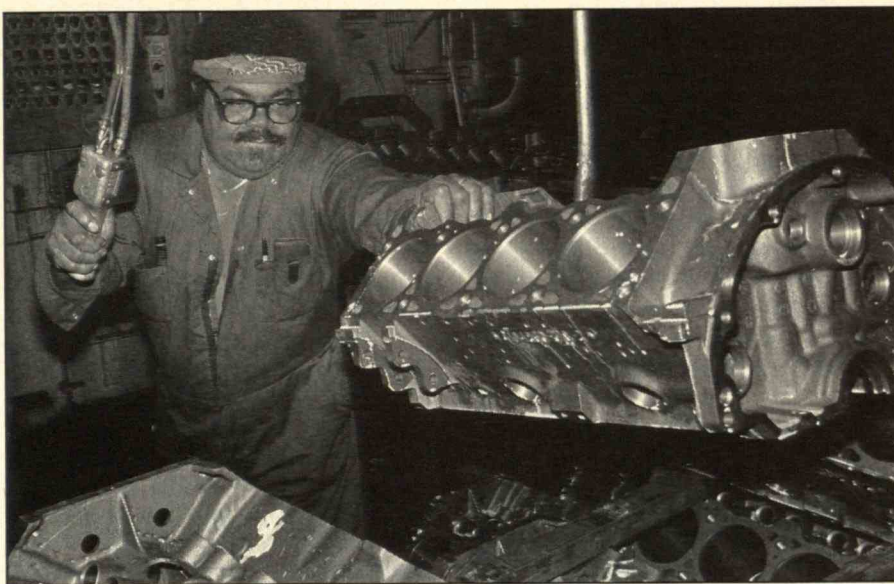
After World War II, Japanese business and government leaders sought to erase the "Made in Japan" stigma associated with poor quality products. The United States assisted by sending W. Edwards Deming, a quality guru who taught the Japanese about "statistical process control" (SPC).

Forty years later, quality obsesses U.S. business and labor leaders. Consequently, SPC is on the front burner in Deming's home country. "Quality has become an essential competitive ingredient. It is a matter of saving jobs," says Donald Ephlin, United Autoworkers (UAW) vice-president emeritus. Robert Zager, from the non-profit Work in America Institute, concurs: "World competition is forcing corporations to improve quality."

By collecting and analyzing production data to identify problems, SPC aims to prevent defects, rather than detect them after a product is manufactured. While detection engages a few select quality-control personnel, SPC needs the ongoing involvement of many production workers and managers, who together to devise improvements to the work process.

At Regal Stamping in Warren, Mich., press operator Marsha Chaney uses SPC. One of 13 workers on a production line, she makes car parts that are sold to the Big Three automakers. "I take a part and fit it on a gauge," says Chaney. "I determine if it is 'out of control' or 'on target.' If a part is out of control, I consult with the quality-control coordinator, foreman, and maybe the die-setter." Then they all discuss how to fix the problem.

"Before we had SPC, there was no way to tell for sure if a part was good or bad," Chaney says. "It's like magic, it opens a door. It's much easier than guessing if a part is good." Of Regal's 150 workers, 120 have learned SPC.



One way firms can improve quality is by teaching both managers and workers like Chaney the basic SPC skills. They can do this with video exercises or classroom teaching, but many large firms are now opting for computer-based courses, such as the package offered by Tech Center in Southfield, Mich. Tech Center's clients include GM, Westinghouse, and Proctor & Gamble.

Their SPC training package, offered in three different modules, runs on a personal computer and uses color graphics. For example, the first module includes a historic narrative explaining that U.S. manufacturing techniques must change to meet competitive demands. It also introduces basic applications and SPC statistical tools. Accompanied by an easy-to-read guidebook, the self-paced program requires students to retain 80 percent of each lesson before moving on. The average student completes the computer-based section of the training in 25 to 35 hours.

According to Tech Center vice-president Susan Garrity, the program succeeds for a wide spectrum of production and management workers, even for those with as little as a fifth-grade reading level. "Businesses have underestimated line workers' ability to learn," she says. "In truth, our best students are production workers."

Repeating the strategy that Japan used after World War II, the auto industry is building co-operation between workers and managers to make a better product.

One operator with a high school diploma commented, "It was a test of my mind to see if I could learn it. I was out of school for 10 years, but I mastered it."

95 Percent Fewer Complaints

Teaching SPC skills is a beginning, but to make the method part of daily operations requires shop-floor training, including setting up and testing ways to improve quality. Management must also continually support workers' efforts to integrate SPC into their work process.

"Few clients do the full time-intensive cycle of skills training and implementation at the shop level," Garrity notes. "Plant managers are still concerned with production quotas, and many ignore implementation steps."

"In the plants where SPC wasn't successful, it had nothing to do with the workers," says an assistant plant manager in an auto supply company that introduced SPC at nine sites. "I fault old-school plant managers who didn't want to give SPC priority."

SPC also requires cooperative—or at least improving—relations between

workers and managers. At its CPC Parma division in Ohio, GM first set up a project to improve labor-management relations and then to tackle technical training. UAW official Joe McAdams says the idea is to first rid the plant of two attitudes: "management viewing SPC as giving hourly workers control to arbitrarily shut machinery down, and hourly workers

viewing SPC as management being punitive."

McAdams believes SPC is on the immediate horizon. "Historically, the company ignored employee demands for training, but now they are receptive to our needs," he says. "We have successfully changed the attitude 'Leave your brain in the parking lot.'"

One of the signposts of management commitment to quality improvement is the number of staff a firm dedicates to that effort. Some companies have created committees with full-time labor and management representatives who determine workforce training needs and design appropriate programs.

However, actually measuring SPC quality improvements—from changes on the production line or from more cooperative relations between labor and management—is not something many companies do, according to Tech Center's Garrity. "Quality is still seen as an outside island," she says. "Management mostly doesn't believe that workers 'can do' [improve quality], so they don't measure it."

Still, there are ways to gauge quality improvement. Lee Johnson, director of quality assurance at Regal Stamping, estimates that scrap and rework at his plant are down 80 percent and customer complaints are down 95 percent. This year, the company won a Ford quality award.

"Three years ago, we used to get 80 customer complaints a quarter. Now we get one complaint, if that," says Johnson. Press operator Chaney agrees: "I don't see reject tags like I used to. I see more approved boxes. I see more being shipped out."

"Workers prefer to do quality work," notes UAW's Ephlin. "No one likes to go home and say they built junk all day." ■

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Training workers in statistical process control can improve product quality. Computer-based courses impart technical expertise while explaining how manufacturing methods influence competitiveness—and jobs.



North Carolina Regulates Biotech

■ In August 1989, North Carolina passed the first comprehensive state law regulating the release of genetically engineered organisms. While some industry groups join environmentalists in welcoming the law, other biotech firms and trade groups call it a prescription for trouble.

According to the Industrial Biotechnology Association, only Minnesota and North Carolina require a permit to release genetically engineered organisms. Oklahoma and New York are entertaining such legislation, while Wisconsin, Hawaii, and Illinois require notification of planned releases.

Beginning July 1, anyone planning to release genetically altered plants or microbes in North Carolina must obtain permission from the state Agriculture Department, whose professional staff will review permit applications. When necessary, department reviewers will have access to proprietary information in the applications.

The final decision rests with a new public review board, with members from the government, state universities, public-interest groups, biotech industry researchers, and farmers, as well as the North Carolina Biotech-



Other states are watching North Carolina's law regulating genetic engineering. It governs research, such as this summer's tests of tobacco plants designed to resist pests.

nology Center, which the state has established to promote the industry. The board will notify affected counties of each proposed release, and citizens can ask for a hearing. Even though the law allows public comment, it prohibits counties or municipalities from further regulating biotech. The review board can issue a limited-use permit for high-risk activities or general permits for releases it judges are relatively safe.

The initiative for the law came from the state Agriculture Department, which foresaw difficulty overseeing releases by the state's expanding biotech industry. The department has been working under a 1973 statute that was "very broad . . . with very little definition," according to Charles Hamner, director of the biotech center. The department wanted better working guidelines, "and they asked us to help."

To design the law, the biotech center assembled a broad advisory committee. Because of considerable confusion among the federal agencies regulating biotech, the group concluded that North Carolina needed its

own "simple, straightforward process [to] ensure that the people of our state would be adequately protected," says Hamner.

The lengthy delays and patchwork of federal biotech regulations have frustrated both biotech advocates and critics. While the process for getting Food and Drug Administration or U.S. Department of Agriculture approval is fairly clear and direct, Environmental Protection Agency regulations are in turmoil. The agency has already spent nearly three years crafting regulations to enforce the two laws it administers that apply to biotech—the Federal Insecticide and Rodenticide Act and the Toxic Substance Control Act.

A Precedent of Sorts

Industry representatives on the advisory committee have high praise for the law. "We were concerned about the existence of state legislation in the first place, but as we participated in the process, we saw the benefits," says Richard Herrett, government-relations liaison for ICI Americas. "Having a law that was put together by all these different interest groups gives us confidence that we can proceed with our business in an orderly fashion."

Similarly, Ciba Geigy's Steven Dumford likes the law's "establishment of a clear operational procedure for registering products that have foreign genes. We designed the bill to be minimally intrusive. It goes hand-in-hand with the federal permitting process."

Environmental groups also applaud the law. "It's the best piece of state biotechnology regulation so far," says Margaret Mellon, who directs the National Biotechnology Policy Center based in Washington, D.C. "It has broad coverage, and it fills the gaps in the federal framework, which are many." Environmental Defense Fund biologist Rebecca Goldberg rarely supports laws preempting communities, but says "this bill is a reasonable

compromise with industry."

Still, not everyone feels state legislation is warranted. "There is a federal framework in place that continues to evolve, and we feel the states should participate in that process," says Marty Strauss, Monsanto's government-relations manager. "Instead of contributing to the synergy at a national level, [North Carolina has] opted for duplication."

"We have a philosophical position against state regulation that duplicates federal regulation, and that's what North Carolina's law does," echoes Mycogen's Joe Panetta. "It allows people to go to the state and make comments. If we have this happening in 50 different states, it creates total chaos."

Even proponents of North Carolina's bill hesitate to call it a national model, but they do assert that other states would benefit from a similar thorough analysis of their ability to regulate biotech. "The bill itself satisfies the needs of North Carolina, and may or may not be appropriate to

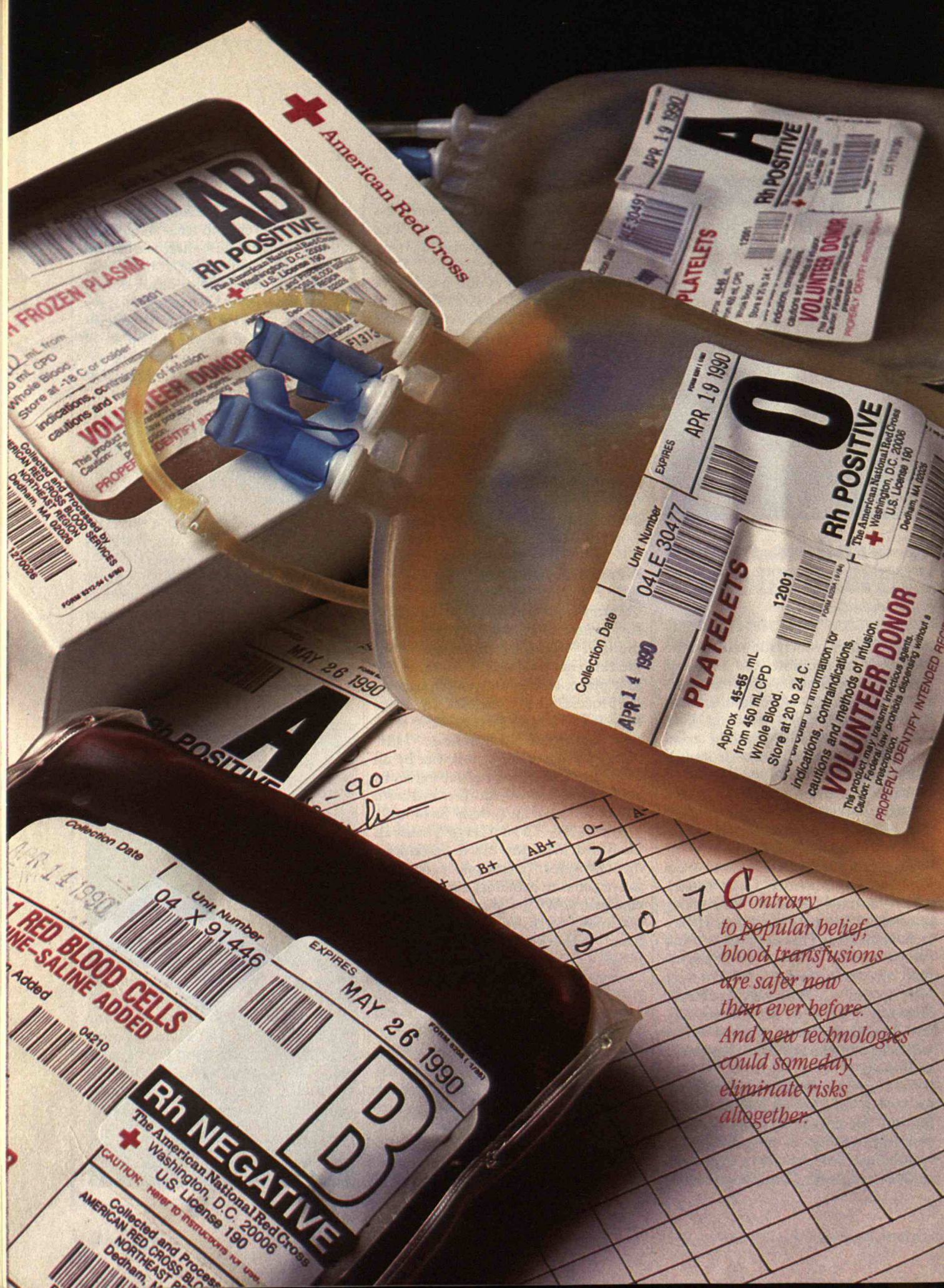
Charles Hamner, director of the North Carolina Biotech Center, says a new state law provides a "simple, straightforward process" to protect the public and encourage research.



other states," says Hamner. "But certainly the process we went through of building consensus among all the various groups is a good model."

As to the impact on biotech, Hamner hopes "this will stimulate more biotechnology activity in our state. In fact," he adds, "we've had several companies say they would like to locate here because of the law." ■

JOHN MANUEL is a free-lance writer living in Durham, N.C.



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12001
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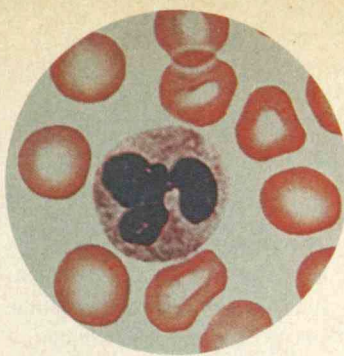
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B+	AB+	O-	A-
2	1	2	1
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Contrary to popular belief, blood transfusions are safer now than ever before. And new technologies could someday eliminate risks altogether.



New Technologies for a Safer Blood Supply

SINCE 1982, when the first case of AIDS spread by blood transfusion was reported, the public has changed its perception of the safety of the blood supply. For years blood transfusions were regarded as the "gift of life," but today many people fear that they could be a source of life-threatening disease.

Ironically, blood transfusions are safer today than ever before. To prevent infections, since 1972 blood banks have introduced six tests and a series of new procedures for interviewing potential donors. After the newest test—for the hepatitis C virus—was implemented this year, the estimated risk of contracting transfusion-transmitted hepatitis dropped to less than 1 in 1,000 to 1 in 200 per unit of blood, down 80 to 90 percent from rates in the early 1960s.

Blood banks have also dramatically reduced the chance of getting the AIDS virus (HIV) through transfusions. Within a few days after the first report that the disease could be spread that way, the American Red Cross and other blood service organizations introduced new standards for donors, encouraged people at risk for AIDS to defer from giving, and encouraged patients to donate their own blood for elective surgery.

The 1985 introduction of a blood test for HIV was highly successful. Although the Centers for Disease Control has identified 3,140 cases of AIDS associated with blood transfusions given before 1985, it has report-

ed only 6 cases associated with post-1985 transfusions. Estimates of the risk of acquiring HIV infection from a unit of transfused blood now range from 1 in 1 million to 1 in 40,000, depending mostly on where the blood is collected. Like all other infections, transfusion-associated AIDS occurs more frequently in geographic areas where the infection is common.

But the goal of a completely safe blood supply remains just that. Further improvements in laboratory testing and selecting donors offer only small, incremental benefits. Therefore, scientists are also looking to new technologies—artificial blood substi-

tutes and processes to inactivate viruses in blood. Theoretically, these longer-term strategies could eliminate all transfusion-caused viral diseases.

Brochures and Lab Tests

Just 10 years ago, giving blood was fairly straightforward. Potential donors had to answer a few questions about hepatitis, malaria, and overseas travel. If people felt well, had normal blood pressure, and were not anemic, they were likely to finish donating blood and be munching donuts in 20 minutes. Today the process of checking the safety of donated blood is far more refined.

Everyone who offers to give blood is asked to read

BY S. GERALD SANDLER AND MARK A. POPOVSKY

PHOTOS: L. BARRY HETHERINGTON

WHAT BLOOD DONORS MUST CONSIDER

Before giving blood, potential donors must read a pamphlet to decide if they are eligible. Under "Patient Safety," the brochure says, in part:

Do not give blood if you are at risk for getting and spreading the AIDS virus. You are at risk if ...

- You are a man who has had sex with another man since 1977, *even one time*.
- You have ever taken (“shot up”) illegal drugs by needle, *even one time*.
- You are a man who has had sex with a female prostitute or a woman who has had sex with a male prostitute in the last six months.
- You have AIDS or one of its symptoms, which include—
 - Weight loss (10 pounds or more in less than 2 months) that you can’t explain
 - Night sweats

- Blue or purple spots on or under your skin
- White spots or unusual sores in your mouth that last a long time
- Lumps in your neck, armpits, or groin that last more than a month
- Fever higher than 99 degrees that lasts more than 10 days
- Diarrhea that lasts more than one month

All donors must also answer questions on a registration form. They are asked, for example, if they have:

- In the past 12 months received blood transfusions, blood injections, or tattoos?
- In the past 12 months been exposed to anyone with yellow jaundice, hepatitis, or on a kidney machine?
- In the past three years had malaria or taken anti-malarial drugs?
- Been to Haiti or Africa since 1977?

■ YOUR SAFETY

To make sure you are healthy enough to give blood, we will—

- Check your temperature, pulse, and blood pressure.
- Test a drop of your blood to be sure you have enough red blood cells to give safely today.
- Ask you questions about your health.

What you tell us about your health will be kept confidential.

If you are able to give, we will take about a pint of blood from your arm. We always use a new,

You cannot get AIDS or any other disease by giving blood.

■ PATIENT SAFETY

Some people must not give because their blood might spread an infection to the people who

- You are a man who has had sex with another man since 1977, *even one time*
- You have ever taken ("shot up") illegal drugs by needle, *even one time*
- You are a native of Haiti, Sub-Saharan Africa, or any island close to Sub-Saharan Africa and came to the United States after 1977
- You are a hemophilic who has taken clotting factor concentrates since 1977
- *More than one factor = multiple risk factor (MRF)*

- Lumps in your neck, armpits, or groin that last more than a month
- Fever higher than 99 degrees that lasts more than 10 days
- Diarrhea that lasts more than one month
- You have, since 1977, had sex with any person described above
- You are a woman or man who has been a prostitute at any time since 1977
- You are a man who has had sex with a female prostitute or a woman who has had sex with a male prostitute in the last six months

Do not give blood to find out whether you have a positive AIDS test. The tests we use are very good, but they are not perfect. A person may be infected and have a negative test result. That's why you must not give blood if you are at risk for getting AIDS. A Red Cross nurse can tell you where you can get an AIDS test without giving blood and without giving your name.

Do not give blood if you . . .

- Have ever had hepatitis (liver disease caused by a virus)
- Have had malaria or have taken drugs to prevent malaria in the past three years.
- Have syphilis

If you decide that you should not give blood, you may leave now. If you're not sure, ask to talk privately with a Red Cross nurse.

[illegible]

a brochure about the risks of infection by blood-borne viruses. The potential donor then fills out a form answering questions about his or her health, previous transfusions, use of drugs with intravenous needles, and sexual behavior—as well as the older questions about hepatitis, malaria, and travel. Depending on the answers, interviewers may question some people more intensively. For instance, those who have gone to a certain part of the world may be asked about any travel shots or malaria pills. Some questions are intended to jog the potential donor's memory about past illnesses. Others are meant to help alert people about personal behaviors that place them at risk for HIV infection, and to persuade them to refrain from donating.

However, as HIV spreads beyond the primary risk groups (men who have had sex with other men and people who have shared IV needles or had sexual intercourse with IV drug users), this strategy will become less effective. Clearly, donor education can't be the only way to ensure a safe blood supply. Therefore, blood banks test all donated blood for HIV antibodies, al-

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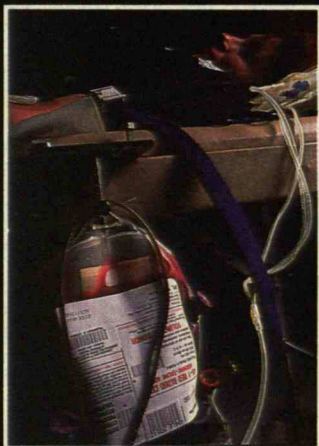
though they continue to use the questions as a backup.

Blood banks also look for antibodies to syphilis and HTLV-I, a virus causing a rare form of leukemia or paralysis. Although precise information on the risk of contracting these diseases through blood transfusions is not available, the best estimates are less than 1 in 1 million for syphilis and between 1 in 600,000 and 1 in 60,000 for HTLV-I.

Finally, blood banks search for viral hepatitis. At least five viruses cause hepatitis, but only two are likely to be spread by blood—hepatitis B and C.

All blood has been tested for hepatitis B since the 1960s. That virus usually causes, if anything, only temporary jaundice, fever, and a loss of appetite. But in a small fraction of cases it can result in liver failure, loss of consciousness, and death. Presently, people have less than a 1 in 2,000 chance of contracting hepatitis B from a unit of blood.

And since the mid-1980s blood banks have looked for evidence of non-A, non-B hepatitis, which in the United States is almost always caused by the hepatitis C virus. People who contract this virus usually have no immediate symptoms. But after harboring a silent infection for many years, carriers may develop cirrhosis—severe liver failure—or lesser forms of liver disease. Blood banks now conduct three tests for non-A, non-B hepatitis. They measure a liver enzyme called ALT and do a hepatitis B core antibody test, which iden-



tifies people at increased risk for the disease. Moreover, since May 1990 blood banks have started routine testing for the hepatitis C virus infection. Since then, the risk of being infected with the virus has dropped from 1 in 100 per unit of blood to between 1 in 1,000 and 1 in 200.

But testing technology also has its limits. One reason is that all infectious diseases have a "window" period when the infection cannot yet be detected. For instance, the procedure for finding HIV-infected blood depends on locating HIV antibodies. Most people make antibodies 6 to 12 weeks after contracting the virus, but some researchers claim to have followed people with HIV infection for as long as 36 months before they developed antibodies. Cases of HIV infection spread by blood transfusions after 1985 have probably stemmed from donors with HIV risk behavior whose blood has been tested during the window period.

Also, tests aren't available for all the infectious diseases that can be spread by blood transfusions. The parasites that cause malaria and Chagas disease—typically a lifelong infection ending in a fatal heart condition—are spread through transfusions in those parts of the world where these infections occur: tropical areas for malaria and Latin America for Chagas disease. And very rarely, blood transfusions have carried parvovirus B19 and the Epstein-Barr virus. Severe parvovirus B19 infections have infrequently been as-

sociated with bone marrow failure and stillbirths. The Epstein-Barr virus is linked to infectious mononucleosis, cancer of the nose and throat, and Burkitt's lymphoma—cancer of the white blood cells. The cases of Epstein-Barr disease linked to blood transfusions have been mild cases of mono.

To reduce blood-related complications, three conferences sponsored by the National Institutes of Health (NIH) have resulted in revised transfusion guidelines. These point out that doctors can safely perform fewer blood transfusions.

When transfusions are needed, doctors are increasingly recommending that people give their own blood—a process called autologous blood donation—for elective operations. Depending on the situation, the blood can be donated before surgery, collected from a traumatic wound or surgical incision and returned after processing (intraoperative salvage), or collected from drainage after an operation and returned intravenously. The last approach is particularly useful in patients undergoing hip or knee-joint replacement, since most blood is lost after the surgery. In some cases, people using autologous donations can completely avert

Before taking blood, a nurse asks about a donor's general health and risk of having contracted infectious diseases. Inset: A volunteer donates blood.



Virus or Disease	Risk Per Unit of Blood Transfused
Hepatitis C	1:1,000–1:200
Hepatitis B	Less than 1:2,000
AIDS virus (HIV)	1:1,000,000–1:40,000
HTLV-I	1:600,000–1:60,000
Syphilis	Less than 1:1,000,000

the need for someone else's blood.

Unfortunately, some people cannot take advantage of autologous blood transfusions. Less than 5 percent of the blood collected in the United States comes under this category. Not everyone needing surgery has enough notice for the 42-day program necessary to donate blood in advance. People needing transfusions for anemia, bleeding ulcers, or hemorrhage after childbirth cannot donate their own blood because typically they are already anemic. Candidates for intraoperative salvage must be selected carefully to avoid spreading bacterial infection or bowel contents from one part of the body to another. And some surgeons hesitate to use intraoperative salvage for cancer surgery because they worry that this could spread cancer cells.

Recombinant human erythropoietin, a drug licensed by the FDA in 1989, has eliminated the need for many non-surgical transfusions by increasing the number of red blood cells produced by a patient's marrow. For example, the genetically engineered drug has dramatically decreased the need for blood transfusions in people who previously depended on weekly transfusions for severe kidney disease. And by stimulating red blood cell production in bone marrow, recombinant erythropoietin should make it possible for people to stockpile more of their own blood before surgery. Research on the amount they could give—and hence how long in advance they would have to donate—is under way.

One further technique by which some people have tried to increase transfusion safety is more questionable. Not uncommonly, people needing blood transfusions ask about delaying the procedure so they can recruit donors from family or friends. But the logistics of matching blood types, conducting necessary lab tests, and delivering the blood of these "directed donors" to the right place at the right time is formidable. Moreover, studies repeatedly show that true volunteers give the most reliable health histories. There is always a con-

cern that recruitment involves an element of coercion and therefore compromises a donor's confidential health history. Directed donors with, say, HIV risk behavior may not "self defer" because of reluctance to reveal personal habits. Unfortunately, such incidents have occurred.

Giving Blood Again— and Again

Since today's strategies for preventing infections are not 100 percent effective, blood banks are seeking new approaches to increase transfusion safety. Studies suggest that tightening donor acceptance criteria and increasing the number of donations from people at little risk of carrying blood-borne infections could improve transfusion safety.

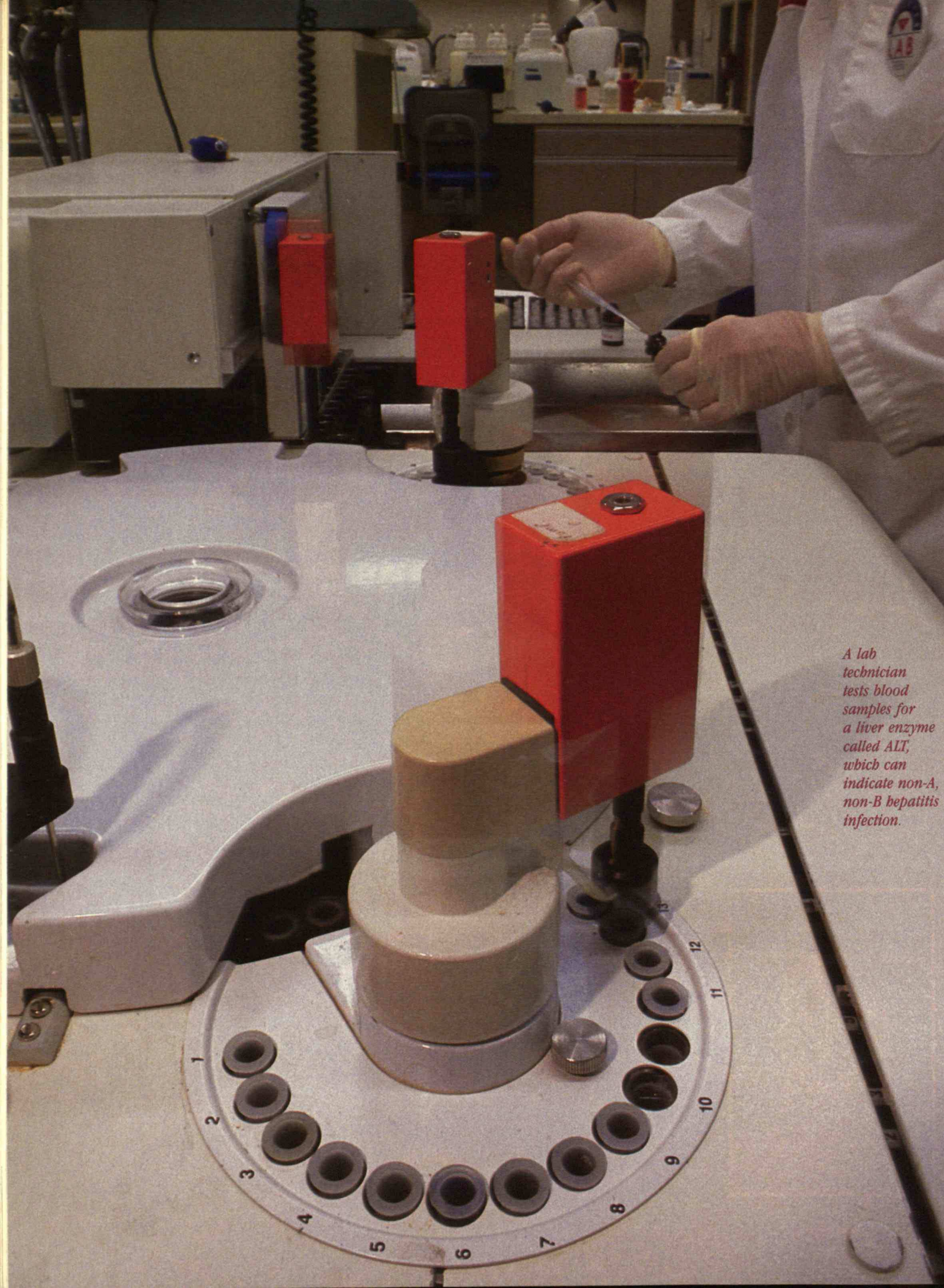
In a 1989 article in the *New England Journal of Medicine*, Red Cross researchers reported that first-time blood donors constitute a disproportionate share of risky donors. Test results for HIV antibodies of 20 million donors showed that men who donated

*Chart above:
The chances of contracting serious infections through blood transfusions are minimal. How minimal depends mostly on where the blood is collected. Blood-transmissible viruses unfamiliar to many people include hepatitis C virus, which can result in severe liver failure years later, and HTLV-I, which can cause paralysis or a rare form of leukemia.*

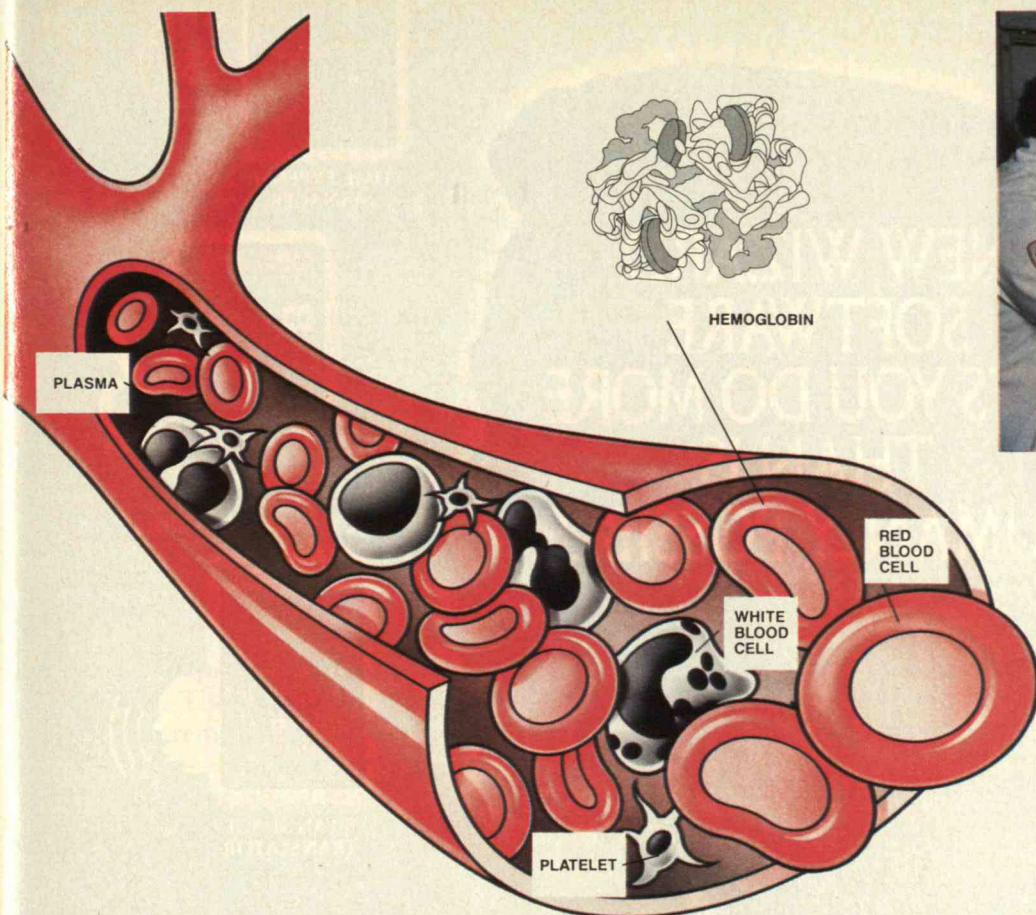
Inset:

A lab technician takes samples of every unit of donated blood to test for the AIDS, hepatitis B, and HTLV-I viruses. Full page: None of this batch of blood-serum samples has reacted to a test for evidence of previous hepatitis B infection. Any reactive samples would have been colorless.





A lab technician tests blood samples for a liver enzyme called ALT, which can indicate non-A, non-B hepatitis infection.



Left: Blood consists of red blood cells and platelets, as well as white blood cells and plasma, which can harbor viruses. Red blood cells contain hemoglobin molecules. Research is under way to develop "artificial blood" made of non-toxic hemoglobin.

Above:

Since red blood cells are the only element needed in most blood transfusions, scientists are trying to find out whether filtering and washing procedures can isolate them.

blood for the first time were 2.7 times more likely to carry the infection than men who had given blood before. Women donating for the first time were 2.4 times more likely to harbor the AIDS virus than repeat female donors. Among the possible explanations are coercive recruiting at workplace and military donation sites, and giving by people who are actually seeking a confidential test for sexually transmitted diseases. Interviews with HIV-infected blood donors support the latter idea.

An appropriate response is to encourage donors in the safer categories to give more often, thereby lowering the need for first-time donations. Informal surveys suggest that donors return when they understand the impact an additional donation may have on both the volume and the safety of the blood supply.

Meanwhile, intensive initial interviews could eliminate more people who could be carrying blood-transmissible diseases. Also, blood from first-time donors could be used solely in manufacturing products such as plasma derivatives and hemoglobin solutions that can be sterilized to eliminate any infection.

Improving lab tests for diseases carried by blood is a less promising option. For instance, the vulnerable window when tests are unable to detect HIV antibodies can't be significantly shortened. The amount of antibodies increases rapidly after the immune system starts responding, and tests for HIV antibodies can already

detect very low levels of antibodies.

Alternative lab tests, such as one to detect HIV infection directly, are also unlikely to have much effect. Theoretical models of HIV infection gave hope that the window period could be shortened using an HIV "antigen" test to detect proteins on the virus itself. However, a 1989 nationwide study testing for HIV antigen failed to detect even one person among more than 500,000 blood donors who had not already tested positive for HIV antibodies. A similar study involving 600,000 European donors had the same result. Antigen may be detected for only 5 to 10 days before antibodies can be found, according to a model one of the authors (Gerald Sandler) and Daniel Mendelson, a graduate student at Harvard's Kennedy School of Government, have constructed to simulate the sequence of events following HIV infection. During the early phase of infection, the virus is located inside white blood cells and thus cannot be detected by the antigen test. Only minimal benefits would result from investing the estimated \$36 million to \$48 million cost that would be needed annually to add the HIV antigen test to the other tests performed on donor blood.



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Trapping Dangerous Blood Components

While blood banks are discouraging high-risk donors, scientists are pursuing two technologies that could eliminate the risk of infected transfusions altogether. One process would sterilize blood before transfusion by eliminating the white blood cells and plasma that can harbor viruses. These blood elements are not essential for most transfusions. Nearly all people needing blood require only red blood cells to correct anemia. Viruses only rarely infect red blood cells.

Supporting this concept, the NIH's National Heart, Lung, and Blood Institute awarded seven grants in 1989 to develop technologies to sterilize blood products for transfusion. The technologies take advantage of the size and stickiness of white blood cells. These cells can be trapped on filters while the smaller, relatively inert red blood cells pass through. Some filters can also remove platelets. The red blood cells are then washed—in a machine reminiscent of the one that separates cream from milk—to remove the donor's plasma and any residual white blood cells and platelets. A centrifuge spins the heavier red blood cells to the periphery. Meanwhile, salt water flowing from outer ports drives the plasma inward toward the center, where it is removed. If these steps do not eliminate viral contaminants, sterilizing chemicals may be added. (However, most scientists are reluctant to add antiviral chemicals because of concern that they could have adverse side effects.)

Preliminary reports suggest that this approach may be effective against HTLV-I as well as cytomegaloviruses, which can cause a mononucleosis-like illness and in rare cases can be life threatening, particularly in newborns. Both viruses are found almost exclusively in white blood cells. Researchers do not yet know whether washing procedures can totally eliminate other viruses, such as hepatitis B, that are typically found in high concentrations in plasma.

The use of blood substitutes—"artificial blood"—is a second approach to eliminating the risk of transfusion-transmitted infections. For years medical researchers have tried to develop red blood cell substitutes that can deliver oxygen and remove carbon dioxide from organs and tissues. In 1957 Thomas M.S. Chang, then an undergraduate at McGill University, made the first successful artificial red blood cells by encapsulating human hemoglobin—a protein found within red blood cells—in ultra-thin membranes made of synthetic polymers, proteins, or compounds called phospholipids, which are found in plasma. Chang showed that these cells could be made as small as one micron, one-fifth the diameter of a red blood cell. But like subsequent versions of artificially encapsulated

hemoglobin, they do not remain in the bloodstream long enough to be useful.

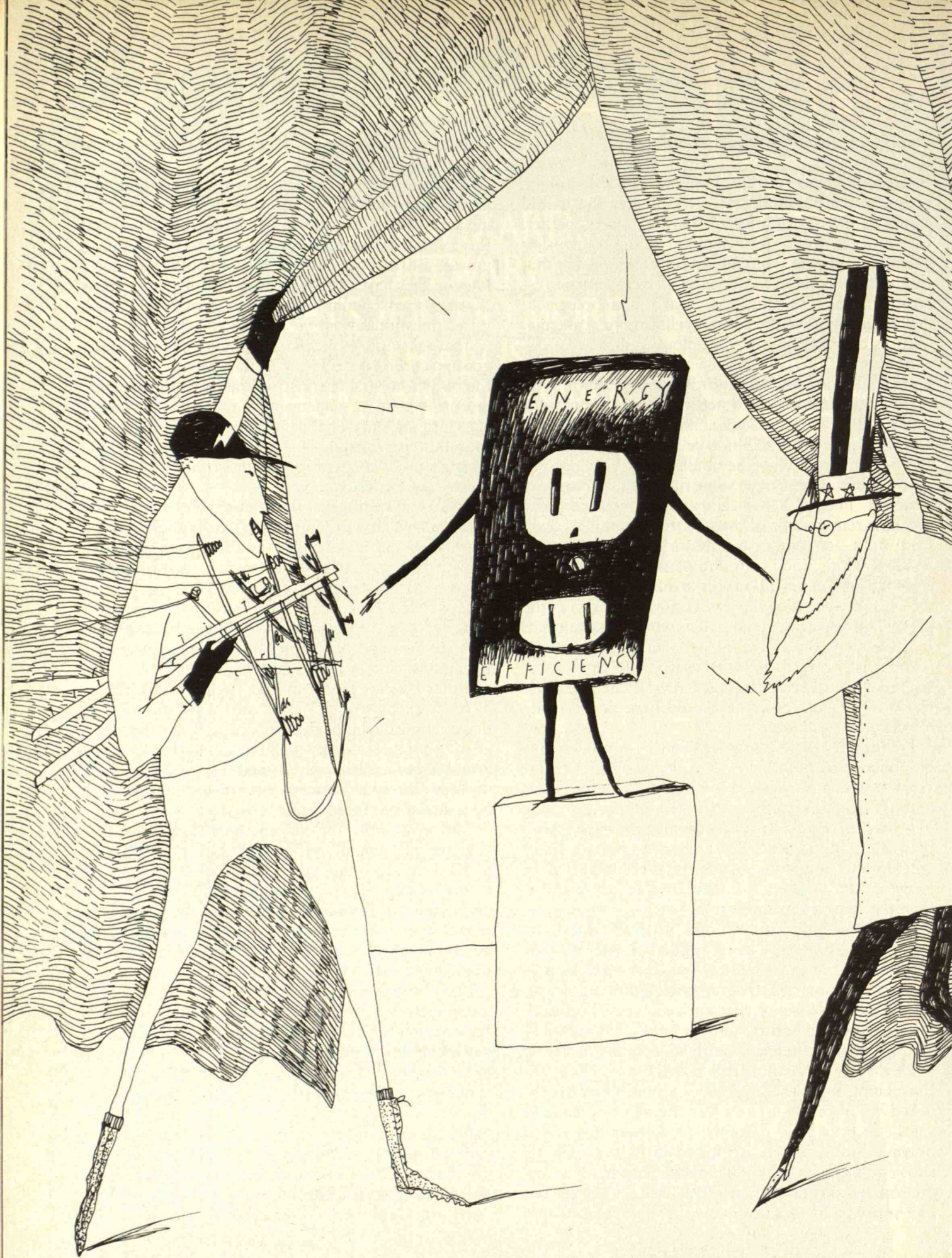
The same is true for a class of synthetic compounds, perfluorochemicals, that researchers are now examining as possible substitutes for red blood cells. And since these chemicals—well-known solvents for common gases—are among the least water-soluble products known, they have to be emulsified into droplets to pass through small capillaries. Early trials in patients have raised questions about the toxicity of perfluorochemical suspensions. While the compounds can carry oxygen and carbon dioxide and by themselves do not alter the body's normal chemistry or activate the immune defense system, a suspension of them can provoke a response. Presumably the immune system recognizes the mixture as foreign. This interferes with the immune system's normal operation against other foreign elements like bacteria.

Another potential substitute for red blood cells is unencapsulated human hemoglobin that has been washed to eliminate any fragments of the original red blood cell walls, which commonly cause toxic reactions. Several researchers have recently increased the time that unencapsulated hemoglobin remains in a recipient's bloodstream. Preparations of unencapsulated hemoglobin molecules await clinical trials to determine their safety and efficacy.

Other labs are trying to develop blood substitutes by cultivating large cultures of "stem cells" (undifferentiated cells) from human bone marrow. So far, the strategy of using these to grow red blood cells that can then be harvested has had only limited success. However, if the technique shows more promise in the future, it could be scaled up to meet clinical needs.

The most promising concept for a blood substitute is genetically engineered hemoglobin. Recombinant technology has the potential to modify natural hemoglobin's molecular structure so that the product can remain in the bloodstream for days. Moreover, researchers do not expect genetically engineered hemoglobin to be toxic because it would not contain fragments of red blood cell walls.

Early studies provide the hope that genetically engineered hemoglobin may be the long-sought solution. But research is needed on all fronts. After all, scientists will inevitably identify new kinds of infections passed by blood transfusions. As the pace of international travel quickens, people are likely to spread more diseases that occur in distant parts of the world. The problem of blood-borne disease is like the mythological Hydra: eliminating one infectious agent is often only a short-lived victory, to be followed by another threat. Technological strategies ensuring completely safe transfusions provide the only foreseeable answer. ■





BY ERIC HIRST

Electricity

Getting More with Less

IMAGINE Exxon running an ad campaign to convince people to drive less. Something like that is happening in the electricity business, and it's not as paradoxical as it seems.

Electricity accounts for almost 40 percent of the energy consumed in the United States. The Department of Energy expects electricity use to rise at about 2.4 percent a year for the next two decades, translating into a 60 percent increase by the year 2010. At that rate, utilities would have to build hundreds of power plants, as well as provide new transmission lines, distribution lines, and substations. The nation's electric bill, already \$150 billion a year, would rise to almost \$250 billion in 1990 dollars.

When the effect on the global environment is taken into account, the real costs are far higher. Burning fossil fuels to generate electricity pollutes the air, acidifies lakes, and raises the possibility for potentially disastrous global warming; electric power plants produce one-third of the U.S.'s output of carbon dioxide, a greenhouse gas. Nuclear power plants

*The
free market
is not providing
economic
incentives to
use electricity
efficiently.
The government
and utilities
need to help.*

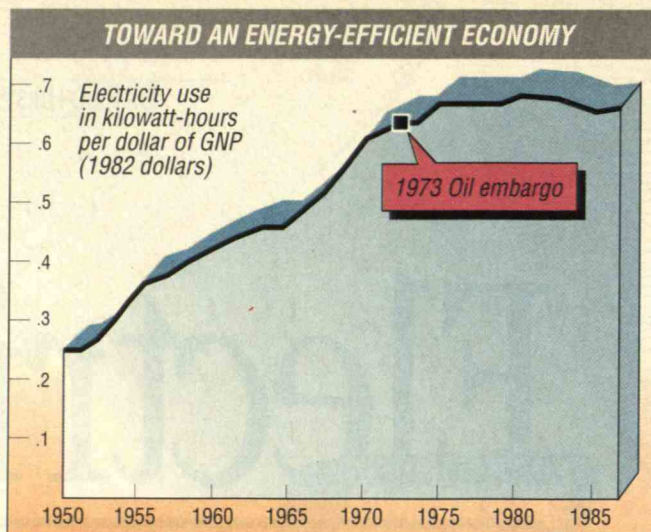
threaten us with waste products that we don't know how to store safely. Hydro power floods land that could otherwise be used to grow food or to house people.

It therefore makes both economic and environmental sense to use electricity as efficiently as possible. It also makes sense for the nation's electric utilities to lead this drive—and for the federal government to offer them guidance and help. Utilities, after all, are not like Exxon. They are granted monopoly power in their markets. In return for this privilege, they should serve the interest of the public as well as of their stockholders.

The opportunities are there. Widespread adoption of new technologies could, for example, cut in half the electricity needed to light commercial buildings. Simple items such as solid-state ballasts make fluorescent lights more efficient, and light fixtures with highly reflective dielectric coatings absorb less light as heat. With less waste heat, efficient lighting also lowers the need for air-conditioning. Another innovation, the so-called smart building, combines computerized management and control of energy systems with sophisticated thermostatic control. For example, multiple thermostats monitor temperature in various rooms within the building and feed the data to a central energy-management computer. This computer analyzes the temperature readings and decides whether it is more efficient to turn on the furnace or air conditioner, or simply to use ventilation fans to distribute heat more evenly.

In the present system of pricing and regulation, however, electricity is so cheap that users and utilities have little incentive to invest in improving efficiency. What's more, efficiency measures tend not to be widely known or available, and their economic benefit can be difficult to assess. In the absence of market incentives, the federal government needs to assume a greater role in promoting efficiency. The federal government therefore needs to take advantage of the influence it wields over the country's electric utilities to promote efficiency.

ERIC HIRST is a corporate fellow at Oak Ridge National Laboratory, where he conducts research on electric utility planning and load management programs. He has a doctorate in mechanical engineering from Stanford.



From 1945 to 1973, the U.S. demand for electricity grew much faster than the gross national product. Thanks to efficiency measures imposed during the oil crises of the 1970s, the economy's energy intensity has leveled off.

The Department of Energy (DOE) should identify ways for utilities to profit from energy efficiency programs, help utilities develop and implement such programs, disseminate information about successful innovations, and conduct research to develop highly efficient electrical products. These activities should properly be catalytic and regulatory—hence inexpensive. By advising and working with a few hundred utilities and their regulators, the government can affect the energy actions of tens of millions of electricity consumers. And the government can change the regulatory landscape in a way that makes efficiency profitable for utilities and their customers. The country—and the world—will then reap the benefits.

Changing the Rules

Most efficiency improvements require an investment: to save money, you have to spend money, whether on new motors for industrial equipment, lighting systems for office buildings, or heat pumps for homes. And it is not easy to find answers to basic questions: How much energy will this new piece of equipment save? How much money will this energy saving translate into? Will this saving remain constant or decrease as the equipment ages?

Other barriers to efficiency resist straightforward economic analysis. For example, builders, not homebuyers, usually decide what appliances and heating systems to install in new homes. Not surprisingly, builders focus more on initial cost than on operating cost, and they choose less expensive, energy-guzzling equipment. And new technologies, such as compact fluorescent lamps, are often not available in many parts of the country.

Another problem is the underpricing of electricity. Utilities charge their customers a rate based on the average cost to provide power. A more accurate measure is the marginal cost—that is, the incremental cost of

adding each additional kilowatt-hour of generating capacity. This distinction is important: the costs to construct and operate new plants are usually much higher than average costs. And, of course, the price we pay for electricity does not compensate for the environmental damage wrought by electricity generation.

Electric utilities and the federal government are well positioned to overcome these market barriers and to increase the efficiency with which consumers use electricity. But the present regulatory system does not reward—indeed, often punishes—utilities for promoting energy efficiency. If electricity sales go down, so do utility revenues. This revenue loss is greater than the reduction in fuel and operating costs, because utilities have enormous investments in power plants, transmission lines, and distribution systems.

To correct this lack of incentive, public utility commissions need to reform their formulas for setting rates. PUCs need to assure that utilities can earn money for their shareholders from programs intended to reduce electricity demand. Such programs are known in the utility business as demand-side management, or DSM. Utility commissions should shift the cost of DSM from the shareholders to the program's beneficiaries: the utility customers. Electricity rates would rise, but experience from on-going DSM programs indicates that the resulting decline in consumption more than compensates: electricity bills drop.

This message is beginning to be heard. Utilities in New York and Rhode Island and Massachusetts are now testing such schemes, and PUCs in Maine, Minnesota, Nevada, and Washington are considering proposed regulatory changes along these lines.

The Efficiency Pioneers

Many of the early DSM programs aim more to improve the utility's public image than seriously to effect electricity use. Customers find their monthly bills stuffed with glossy brochures about conservation. While this is fine as far as it goes, significant efficiency gains will require more substantive measures.

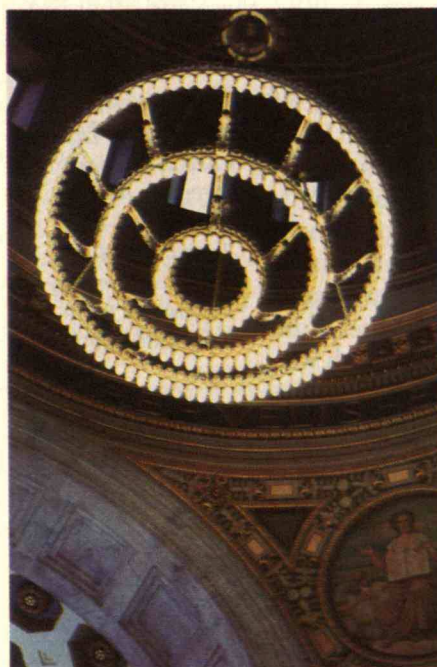
Some utilities are already showing the way. These companies provide financial incentives to customers who purchase efficiency measures, such as new lighting systems in office buildings, efficient appliances in homes, and adjustable-speed drives for industrial motors. The incentive takes the form of rebates, low-interest loans, or even free installation.

New England Electric, facing rapid economic growth

in the region and dwindling opportunities to build power plants, began an ambitious series of DSM efforts in 1987. The budget for these programs increased from \$24 million in 1988 to \$40 million in 1989 to \$65 million in 1990. The company, which operates in Massachusetts, Rhode Island, and New Hampshire, now spends more than 4 percent of its total revenues on DSM programs. New England Electric estimates that although power consumption has risen, it is 3 percent lower than if these programs had not been in place. During the next 20 years, the company expects these programs to fill a quarter of the gap between energy demand and existing generation capacity.

A New England Electric program called Design 2000 aims to improve the energy efficiency of new commercial buildings. It offers cash rebates to cover the added costs of buying and installing efficient equipment. One major client of Design 2000, Digital Equipment Corp., expects to cut the annual electric bill at its Andover, Mass., facility by one quarter. The office, manufacturing, and warehouse complex will install programmable controls and high-efficiency air conditioners, lamps and fixtures. Variable-speed motors will avoid the energy-draining starts and stops of conventional motors.

Some DSM measures do not so much reduce consumption as reschedule it. Power companies pay close attention to their peak load—the amount of electricity drawn at the season and time of day when demand



The 360 fluorescent bulbs in this Rhode Island State House chandelier use \$2600 less electricity per year than the incandescent bulbs they replaced. The conversion was part of a program funded by DOE and New England Electric.

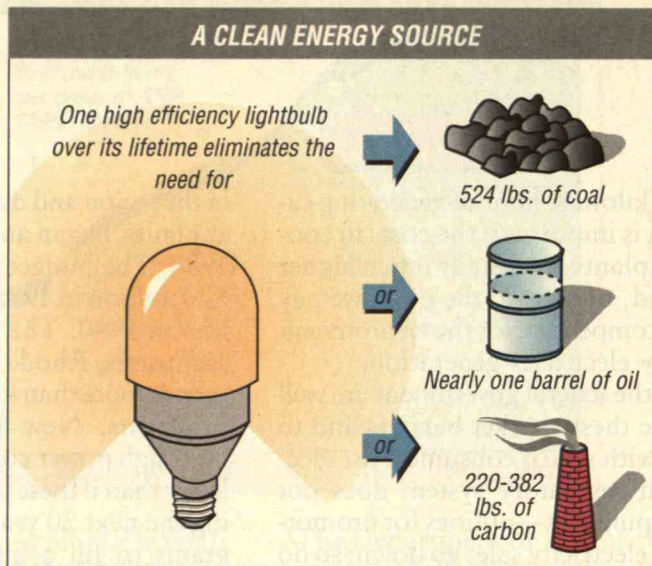
is highest. It is this maximum demand that determines how many kilowatts of capacity a utility must have available. By reducing its peak load, a utility can defer construction of new power plants without lowering its revenue.

In one peak-shaving method coming into use, the utility strikes a deal with some of its customers. In return for a discounted rate or monthly rebates, the customer promises to turn off its energy-intensive equipment when power demands approach the limits of generating capacity. Central Maine Power, a medium-sized utility, has had particular success this way: paper manufacturers turn off their pulping machines, and ski resorts defer snowmaking until after the peak period. Contracts between the utility and customer specify the annual payment, the number of times the utility can interrupt, the amount of notice required before the interruption begins, and the maximum number of hours each interruption can last. In 1988, this program cut the utility's winter peak demand by about 7 percent.

One of the nation's largest utilities—Duke Power, based in Charlotte, N.C.—is using the same method. Duke buys from willing customers the right to turn off air conditioners and water heaters as the demand for electricity nears capacity. In 1987, these and other programs cut summer and winter peaks by 18 and 24 percent.

There are other methods of peak shaving. New England Electric is paying almost \$200,000 to design and install a special cooling system at an office complex in Andover, Mass. Refrigerators will make ice at night, taking advantage of special off-peak rates; during the day, an ice-water slush will course through pipes to cool the building. The office complex will save about \$115,000 a year, and the utility will make use of otherwise idle capacity.

Innovative program ideas continue to emerge. In Rhode Island, three utilities and two state agencies (the Public Utilities Commis-

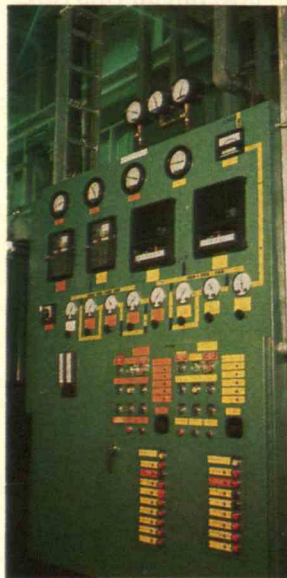


Cutting the consumption of electricity reduces the use of environmentally damaging sources of energy.

sion and the Office of Energy Assistance) combined forces to develop new programs to improve lighting efficiency in commercial buildings. DOE provided a small sum (less than \$50,000) as seed money. Since then, the utilities have been paying for the program. After a year of operation (1989), these programs had installed over 250,000 high-efficiency lamps in more than 2,000 businesses.

The idea of treating efficiency as an energy resource has brought together several New England utilities with a traditional adversary. Northeast Utilities, which operates in Connecticut and Massachusetts, plans to spend almost \$200 million by 1994 on DSM programs it designed in collaboration with the Conservation Law Foundation. Northeast Utilities paid \$200,000 for energy experts selected by the Foundation—an organization that had criticized Northeast for its lack of efficiency activities.

Massachusetts Electric pays Liquid Carbonic to turn off its power during peak hours. The Tewksbury, Mass., chemical company has earned more than \$180,000 this way.



The Selling of Efficiency

Despite the large potential savings, the benefits of electrical efficiency will remain untapped unless government policies and utility programs change. Conserving energy rarely ranks high on an individual's or a corporation's list of concerns. Utilities trying to induce customers to adopt efficiency measures should therefore focus not on saving electricity per se, but on improving the quality of the output. Retail stores, for ex-

ample, care far more about the appearance of lighting than the cost. A utility program for more efficient lighting should address the retailer's interest in color and intensity of lighting and the placement of fixtures.

The federal government contributes to the cause of efficiency by sponsoring research on energy-saving technologies. Lawrence Berkeley Laboratory's research on heat flows through windows, for example, led to the development of low-emissivity windows with an insulating value one third better than that of conventional double-pane windows. Low-e windows have been on the market since 1983, and sales have grown rapidly. Lawrence Berkeley Lab continues to study alternative window designs. They have found, for example, that filling the space between window panes with argon reduces heat flow by another 25 percent.

Other national lab research promises greater efficiency in heat pumps—the reversible appliances that cool buildings in the summer and heat them in winter. Conventional heat pumps turn a compressor on and off to adjust the temperature. Energy is wasted every time the

motor cycles off and on. Oak Ridge National Laboratory is working with manufacturers to develop heat pumps with variable-speed motors, which would allow the compressor to slow down and speed up to match the demand of the moment. These heat pumps promise a 40 percent gain in electrical efficiency.

But merely funding research is not enough. The federal government should gather and distribute information about efficiency methods and technologies. The Reagan Administration opposed federal energy efficiency efforts. This attitude has skewed the activities of DOE's Energy Information Administration (EIA). While collecting monthly data on production of all fuels and electricity, EIA conducts detailed surveys of energy use only once every three years. And it collects almost no data on utility energy-efficiency and load-management programs. This lack of information makes the overall accomplishments of utility-sponsored efficiency programs hard to gauge. Under the Bush Administration, interest in efficiency has grown. Already, EIA has expanded one of its data collection forms to

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require some information on utility DSM programs.

More and better information on energy-use patterns would help utilities design and manage efficiency programs. Such information might show whether and why consumers participate in these programs, why they buy the appliances they do, and how they run and maintain them. It would be valuable to know, for example, the extent to which consumers are swayed by salespeople when shopping for energy-intensive appliances, such as refrigerators. If people tend to make up their own minds, utilities should target efficiency information directly at consumers. Otherwise, the logical target would be the appliance dealer.

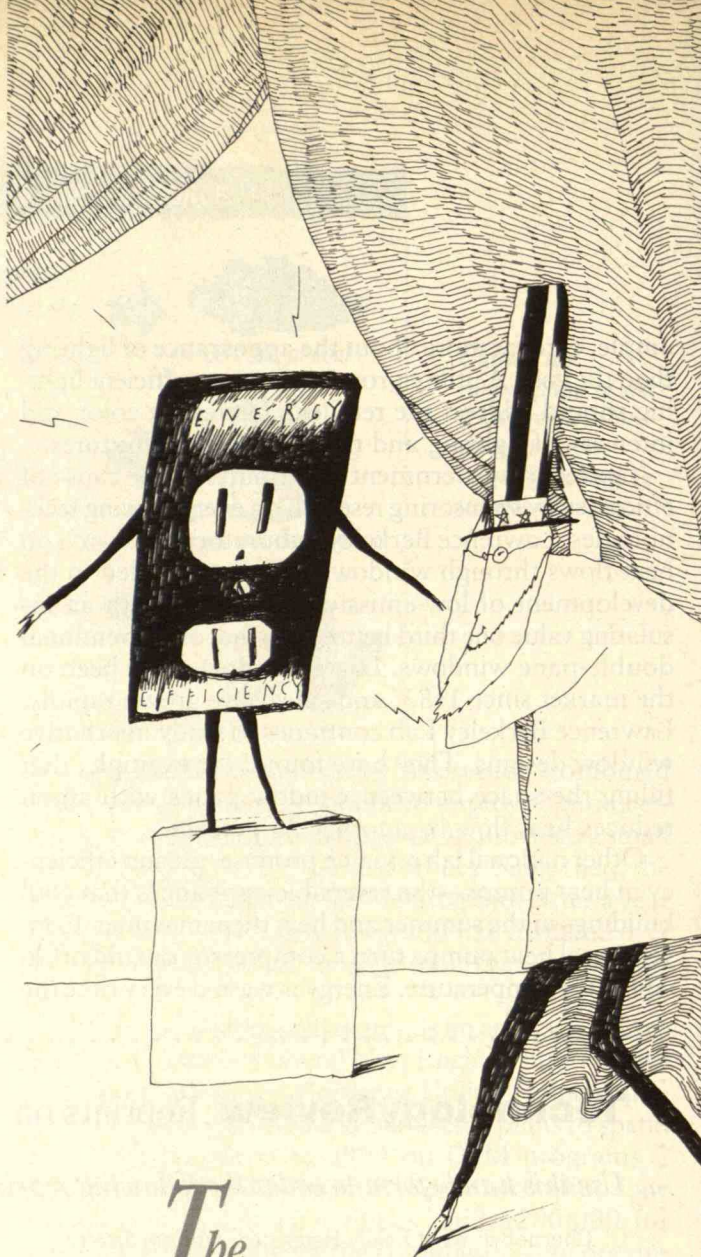
Further analysis of these data by EIA might answer other important questions. Some suggest, for example, that much of the energy wasted in commercial buildings stems from poor maintenance. Dirty filters hinder airflow, for example, and imbalanced ventilation systems distribute heat unevenly. By finding out more about the training of maintenance staff, EIA might reveal a major opportunity for saving energy.

DOE could also perform a valuable service by carefully evaluating utility-run efficiency programs and then paying for reports and conference presentations to share this information with other utilities and state agencies. On a small scale, DOE has shown that it can play such a catalytic role with its involvement in a project called the Northeast Region Demand-Side Management Data Exchange, or NORDAX. Conceived by a consortium of New York utilities, NORDAX maintains a database on 120 efficiency programs operated by more than 30 utilities. DOE funding got NORDAX off the ground and conferred legitimacy; utilities and state agencies were more willing to join the project because of DOE's participation.

The NORDAX database helps members plan and design new programs. Before a utility starts offering rebates on high-efficiency refrigerators, for example, it can check to see how similar programs have fared elsewhere.

Further Federal Action

The government can do still more to encourage energy efficiency. Take, for example, the Federal Energy Regulatory Commission (FERC), which must approve all wholesale transactions among utilities. Before permitting a utility to buy additional generating capacity, FERC could require it first to fill as much of its needs as possible through cost-effective efficiency measures.



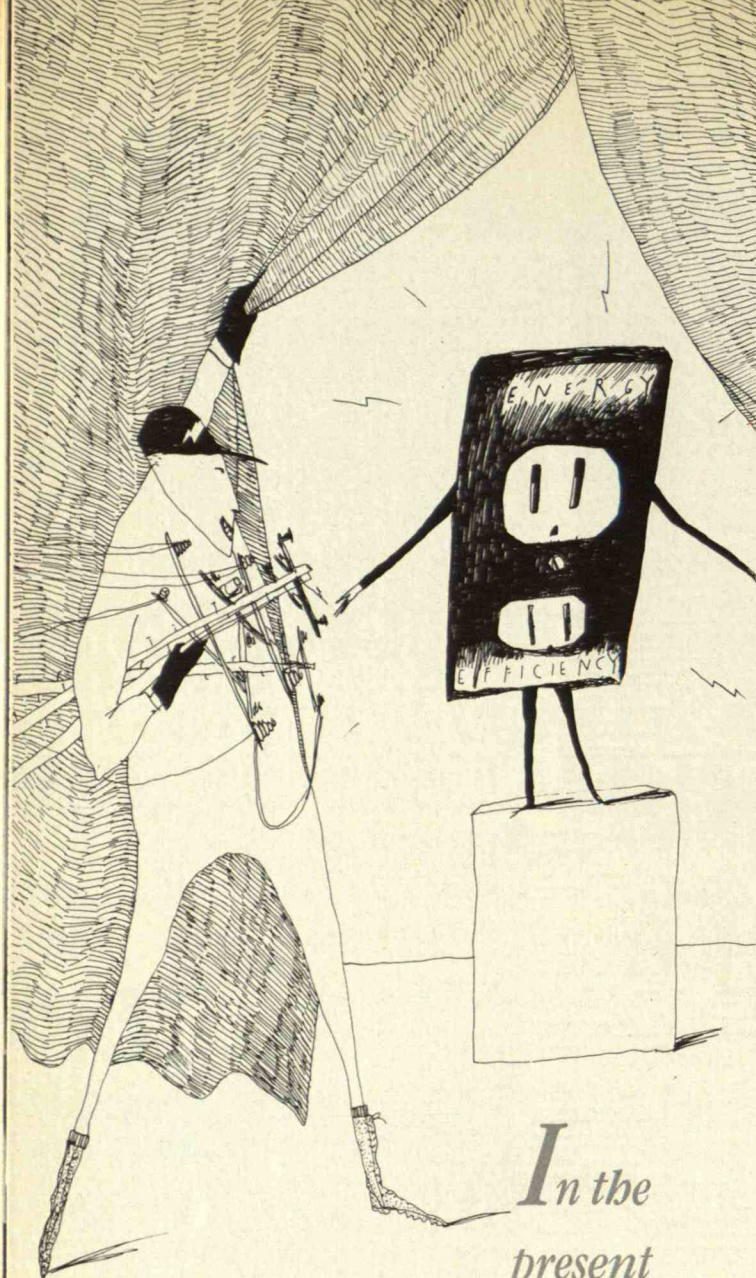
*The
Energy Department
needs to collect
and distribute
information on
how energy is
used, not just
on how it is
produced.*



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*In the
present
pricing system,
electricity is
so cheap that users
and utilities have
little incentive to
invest in
improving
efficiency.*

That way, if a utility proposed to purchase power at 6 cents per kilowatt-hour, it would have to document its plan to make all the possible efficiency improvements costing less than that.

The government can also lead by example. DOE power-marketing agencies such as the Bonneville Power Administration—along with the Tennessee Valley Authority, an independent federal corporation—provide almost a tenth of the electricity consumed in the U.S. These organizations have traditionally operated efficiency programs that not only saved energy but served as models for other utilities. Unfortunately, short-term budget considerations have forced both Bonneville Power and TVA to retreat from the efficiency front. Indeed, TVA canceled all its conservation programs in 1989.

Particularly helpful would be legislation requiring federal power authorities to expand their conservation programs and to consider environmental factors in their cost-benefit analyses of resource alternatives. A precedent exists in the 1980 Pacific Northwest Electric Power Planning and Conservation Act, which made conservation the electricity resource of choice for the Bonneville Power Administration. This means that Bonneville will opt for conservation measures even if they are up to 10 percent more costly than the best supply alternatives.

Looking Ahead

The United States has already proven its ability to use less electricity. In the postwar boom years 1950 to 1973, electricity use in the U.S. grew an average of 8.0 percent per year—much more rapidly than growth in the gross national product. Increasing electricity use seemed to be bound inextricably with economic expansion.

The picture changed dramatically after the oil shocks of the 1970s. Consumers, business, and government struggled to wean themselves from suddenly expensive foreign oil. The government applied tighter efficiency standards to appliances and new construction. Utilities set up load-management programs to reduce electrical consumption. New technologies arose to ease the crises. As a result of these efforts, electricity demand between 1973 and 1988 grew by only about 2.7 percent a year—roughly the same as the growth in GNP.

During the 1980s, conservation passed out of fashion. With oil prices falling, and supplies steady, cutting energy use lost its urgency. But while electricity users have less short-term economic incentive to conserve, evidence mounts that our wasteful ways threaten the very health of the planet. Those who supply and regulate electrical power have an opportunity—and duty—to respond. ■

MIT

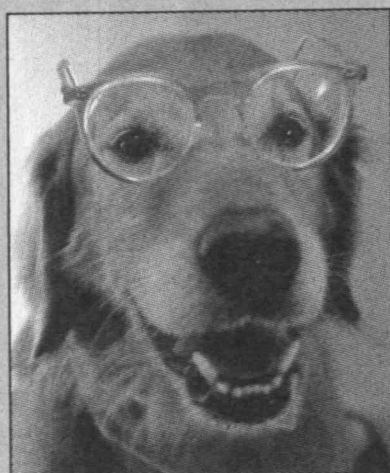
JULY 1990



FOR HIM, MIT WAS HOME

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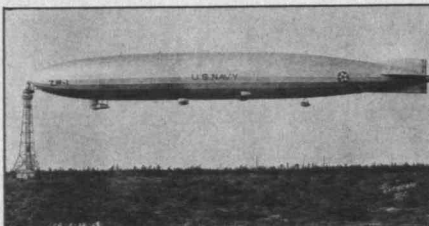


COVER:

Beau, a golden retriever belonging to EECS Project Manager Ed Moriarty, '76, died recently after spending most of his life at MIT. Photo: Henry Gross



LETTERS



The first American-made zeppelin, the U.S.S. Shenandoah, completed in 1923.



Goodyear's first blimp, the Pilgrim, built in 1925.

BLOOPS!

The Akron and Macon are referred to as "blimps" in "Aero & Astro: Still Flying After All These Years" (January, page MIT 8-12). Blimps are blimps (non-rigid) but the Akron and Macon (as was the Shenandoah) were dirigibles (rigid). Oh, well . . . nobody is perfect!

LARRY BODY, '46
Santa Ana, Calif.

Well, Mr. Body is mostly right, and it is confusing, so we turned to Goodyear for help. They explained that dirigible is another name for airship, which by definition is a "lighter-than-air craft that is engine-driven and steerable." The word "dirigible" actually is derived from "to direct," not "rigid." Blimps are non-rigid, zeppelins are rigid, and both are airships. So all blimps are dirigibles, but not all dirigibles are blimps. We hope we've got it now!—Ed.

ONGOING ISSUE: ADMISSIONS

"The Verdict Is in on Admissions" (January, page MIT 2-7) as it pertains to affirmative action prompts me to ask: With respect to society in general, should MIT be more of a window or a mirror? Admission policy may create either.

Admission policy may emphasize diversity by favoring the best member applicants from particular subgroups, based on race, gender, or other characteristics, rather than accepting the best with respect to all other applicants. In

an entering class of fixed size, this may eliminate the window of opportunity for some superior students.

Diversity is undoubtedly a good thing, and its considerable merit has nowhere been more eloquently stated than in an article entitled "Freedom and Probability" by H.B. Phillips in *Technology Review* (April 1956): "Social conditions leading to the greatest diversity of individual action provide the greatest probability that the right course of action will be chosen."

Diversity is certainly fundamental to human, social, and political evolution and is essential in employment and representative government. Diversity also has a place in higher education admission. Fully state-supported schools such as Berkeley, for example, must emphasize diversity in admissions to accommodate the wide ethnic mix of the entire state of California.

But is MIT, or should it be, no more than a microcosm of society-at-large? Isn't MIT intentionally elite, independent, and almost unique? Should MIT emulate any other school in admission policy? Should perfunctory affirmative-action guidelines be used to amplify the inevitable diversity obtained in any 1,000-plus-member entering class?

The Committee on Undergraduate Admission and Financial Aid (CUAFA) report is a good beginning. Certainly more appropriate admission criteria will be available when the best undergraduate student characteristics, by MIT's own standards, are directly matched against identifiable admission application features.

It may be informative to also consider, in making admissions decisions, the proportional extent to which women, minorities, and other subgroups are represented among the MIT faculty, national academies of science and engineering, and winners of Nobel Prizes and National Medals of Science.

Finally, during the *Campaign for the future*, it may be timely to consider the long-term financial implications of admission selection. An analysis of Alumni Fund contributions from women and minorities may provide guidance on the optimum mix of applicant types to admit.

ROBERT M. COPSEY, '44
Hidden Hills, Calif.



Divestiture Redux

FRIDAY, 3/2: *Pro-divestment demonstrators rush the Faculty Club elevator in an attempt to gain access to a Corporation luncheon; five Campus Police injured.*

FRIDAY, 4/6: *A shanty is erected near Student Center; 26 demonstrators arrested, 10 Campus Police and protestors injured.*

MONDAY, 4/9: *Another shanty, three more arrests.*

TUESDAY, 4/10: *Paul Gray meets with Coalition Against Apartheid, agrees to temporary shanty.*

WEDNESDAY, 4/11: *Advisory Committee on Shareholder Responsibility meets to hear views.*

TUESDAY, 4/17: *Graduate Student Council votes to condemn administration's response to CAA protests.*

WEDNESDAY, 4/18: *Faculty meeting votes on a resolution critical of arrests.*

Four years after the last large-scale calls for MIT to divest its portfolio of investments in companies doing business in South Africa, the issue is again on the front burner.

During that time, MIT's investments in such companies have dropped from 18 percent of its total holdings to 5.4 percent, largely because firms in which MIT holds stock have been withdrawing their operations from South Africa. The MIT Coalition Against Apartheid (CAA) uses a broader definition of "doing business" that includes companies with distribution agreements, licenses, outstanding loans, franchises, or employees in South Africa. By that standard, stock in

companies involved in South Africa makes up approximately 19 percent of MIT's portfolio, but still represents a decrease from previous years. The differing definitions and dollar amounts are one element in the ongoing campus debate.

But the primary aim of the CAA is to convince the Corporation, one way or another, to sell all of its stock in companies with operations or otherwise doing business in South Africa. The renewed efforts to promote this cause have put the issue back on the front pages of *Tech Talk*, *The Tech*, and the *Thistle*, an alternative campus publication.

At the two demonstrations in early April, members of the CAA attempted to erect shanties near the Student Center in symbolic protest against MIT's investment policies. A total of 32 people (26 students, a lecturer, and several others) were arrested while campus police were endeavoring to remove the unauthorized structures. At the first rally, eight police officers, a student, and a maintenance worker were hurt in the scuffle. In the following weeks, the appropriate handling of dissent, for both protesters and administration, appeared to be a bigger issue on campus than the question of whether MIT should take a more strongly anti-apartheid stand.

President Paul Gray, '54, met formally with members of the coalition the day after the second incident and agreed that "a portable shanty would be acceptable, one that would be taken away at the end of the day." He also agreed to order "a little emotional and physical distance" between Campus Police and demonstrators. A

third demonstration on April 10 was held without incident or uniformed police presence.

The following day, MIT's Advisory Committee on Shareholder Responsibility (ACSR), chaired by Reid Weedon, '41, met to hear the opinions of members of the MIT community. Eighty-five people attended the meeting and 22 voiced their concerns—heavily pro-divestment—to ACSR. The ACSR will make recommendations to the Corporation Executive Committee, which is responsible for managing MIT's investments.

The Rev. Scott Paradise, Episcopal chaplain at MIT, said that ignoring the moral side of the issue sends a message to students and the world "that money is all that matters." Christine Coffey, '93, observed that "apartheid is a blatant violation" of MIT's policy of nondiscrimination. EAPS Administrative Assistant Katherine

Ware commented that to avoid divestment because it is not viewed as being in MIT's best fiscal interests ignores the possibility that MIT "will lose our entire investment in a [South African] revolution that will be violent and bloody." Citing the profits to be made by companies taking advantage of South Africa's cheap materials and cheap labor force, graduate student Steven Penn, '85, said: "When we continue to invest in South Africa, when we do not take a stand of divestment, we are once again judging that profit will go above the rights and freedom and the peace of people in this world."

In "An Open Letter to the MIT Community Concerning South Africa and MIT Investments" (*Tech Talk*, April 4), Paul Gray set forth the rationale behind the Institute's investment policies. He stated that MIT invests only in corporations that are signatories of the Statement

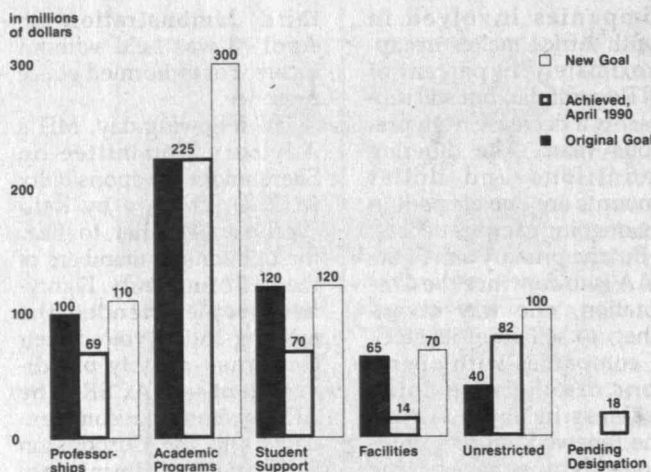


Campus Police move in to arrest demonstrators on Friday, April 6.

of Principles (formerly the Sullivan Principles) and that are making significant progress in their implementation. "In light of recent changes in South Africa," said Gray, "this is not the time to take a vote of no confidence in those very companies that can help support the fragile infrastructure of economic and political equity in this African nation."

In addition to expressing the Corporation's doubts about the efficacy of divestment in improving the lives of South African blacks, Gray observed that "Divestment by an institutional investor is a public act of disapproval of the policies and practices of the affected corporations." If MIT disapproves of the practices of the 52 companies with equity and non-equity links to South Africa in which it holds stock, he said, that disapproval should logically extend to refusing gifts from them. "Along these lines, we should also refuse to continue other relationships with [these companies] such as recruiting access to our graduates, participation in work-study and internship programs, research sponsorship, and membership in the Industrial Liaison Program." MIT's relations with these companies strengthen the Institute's academic programs, Gray stated, and breaking the ties would not be in MIT's interests.

At the April faculty meeting, a group of eight faculty presented a resolution regretting the physical confrontations and urging the administration "to take all feasible steps" to have the charges dropped against those arrested; the measure passed by a vote of 25-13. A similar motion had been approved by the faculty in the spring of 1986, when eight



Campaign for the Future

students were arrested. Several faculty members questioned whether the lessons of the 1960s and 1986 had been forgotten.

The most recent resolution also called for the establishment of a Standing Advisory Panel on Demonstrations to set policy, to "be consulted in times of crisis, and to monitor police action and other participants' involvement in major political demonstrations on campus." A vote on this measure was postponed until the May faculty meeting to allow for further discussion.

A day before the April faculty meeting, the Graduate Student Council (GSC) passed a resolution condemning the decision to make arrests "instead of adopting a negotiated settlement" and urging that all charges be dropped and all fines and court costs be paid by the MIT administration.

In his response to the faculty and GSC requests to drop the charges and reimburse those arrested, President Gray said that it would be "inappropriate" to tinker with the judicial system. He recalled that the administra-

tion's efforts to have the charges against the protesters dismissed in 1986 were refused by the judge, who stated that the criminal process, once invoked by making an arrest, must be allowed to proceed. That judge, by coincidence, is the same one hearing the most recent arrest cases.

The president did voice his support for more dialogue between MIT and the CAA. At the faculty meeting he quoted Winston Churchill's comment that "jaw, jaw is better than war, war," adding that "We're going to keep on jawing as long as . . . there is a chance to talk without the need of bullhorns." To that end Gray invited members of the Corporation's Executive Committee and members of the CAA to have a discussion about divestment as *Technology Review* was going to press in early May. Also scheduled was a colloquium on apartheid sponsored by the Undergraduate Association, with President Gray and Lindiwe Mabuza, the leading Washington representative of the African National Congress. □

Campaign Goal Raised

When MIT's *Campaign for the future* was launched in October 1987, the goal was to raise \$550 million over a five-year period. Thus far, \$478 million of that goal has been realized, prompting the MIT Corporation to vote in March to increase the goal to \$700 million at the recommendation of President Paul Gray, '54, and Vice-President and Treasurer Glenn Strehle, '58.

The *Campaign* is approximately \$100 million ahead of its projection for this stage in the fund-raising. The monthly growth rate of just over \$9 million is \$2.5 million better than expected. The additional \$150 million is earmarked for four of the five designated priority areas (see chart at upper left).

The Alumni Fund has committed to increasing its contribution to the *Campaign* from \$100 million to \$120 million in gifts and pledges. Meanwhile, the Koch Challenge has been accepted by some 8,000 donors—and it is expected that the challenge funds will hold out until the end of the fund year (June 30th) for all eligible contributions. □

ROTC Policy Under Attack

A perennial issue on many campuses across the country is the presence of the Reserve Officer Training Corps (ROTC). After the turbulence of the Viet Nam War, ROTC recovered slowly from its all-time-low enroll-

ment in the mid-1970s, but by 1986 it was quietly thriving again at MIT and elsewhere. The 125-year-old program now provides military training and \$3.3 million in tuition for 220 MIT undergraduates.

Although MIT did not evict ROTC during the Viet Nam War (as some universities did), and continues to endorse its presence, the Institute has been concerned about lingering discrepancies between certain ROTC policies and policies at MIT. Now that the Navy ROTC has discharged a midshipman because of his admitted homosexuality and demanded that he repay the \$38,612 spent on his education, those policy conflicts have become a high-profile issue at the Institute.

Robb Bettiker, '90, was "disenrolled" along with David Carney, a fifth-year Harvard College student participating in MIT's ROTC program, when they revealed their homosexuality to their commanding officers. Although the local unit of ROTC recommended that the two students not be required to repay their scholarship money, the secretary of the Navy sent them letters asking them to "acknowledge indebtedness to the U.S. Government for advanced educational assistance." Neither student has signed the form.

MIT, along with many other universities, has a specific policy against discrimination on the basis of sexual orientation. In a report on the MIT-ROTC Relationship last fall, a faculty committee observed that "MIT has apparently accepted, with some discomfort, that an exception to its nondiscrimination policy would be made in the case of the ROTC units."

ROTC policy, while varying in language among the Army, Navy, and Air Force, bars gays and lesbians from military service. If it comes to light that an already-enrolled ROTC student is a homosexual, he or she is discharged and any scholarship is terminated. The circumstances under which tuition must actually be reimbursed to the program remain murky: in the Army, for instance, if it is determined that a student lied about sexual orientation when applying, he or she "could be required to pay back all disbursed money to the military." If the student discovered his or her homosexuality while in ROTC, further scholarship is denied but funds already received are not recalled. It is also unclear whether ROTC policy makes a distinction between sexual orientation and activity.

Bettiker maintains that he was not aware of his homosexuality when he enrolled in ROTC and would not have joined under false pretenses. When he realized he was gay, Bettiker says, he told his commanding officer in order not to compromise his integrity by lying about his sexual orientation. He stated that his performance as a midshipman was unaffected by his homosexuality, and he believes that he should receive his commission.

Provost John Deutch, '61, long considered a supporter of DOD-sponsored activities at MIT, has written a letter of protest to Secretary of Defense Richard Cheney. In the letter, Deutch expressed his belief that the ROTC policy discriminating on the basis of sexual preference is wrong and asks that the DOD reverse its stand "just as it has reversed prior dis-

criminatory policies against blacks and women."

Deutch went on to stress the importance of maintaining strong ROTC connections for the benefit of both the military and the students. Not only is there a strong likelihood of universities withdrawing from the program if discrimination continues, he wrote, but there will be increasing hostility against the DOD on campuses where ROTC remains and sentiment is already divided on the subject. The students who depend on ROTC scholarships would suffer if the number of participating schools drops and the military would be worse off as well, because "the ROTC program provides a continuing source of educated and motivated officers for the nation's defense establishment."

A faculty-student group called Defeat Discrimination at MIT has gathered more than 2,000 signatures urging the Corporation to eliminate MIT's ROTC program by June 1994 unless the military ceases to discriminate on the basis of sexual orientation. Dean for Undergraduate Education Margaret MacVicar, '65, (the senior MIT officer responsible for ROTC) issued a statement that said, in part: "Current DOD policies that exclude gays from participating in its ROTC programs run counter to the values of inclusion and equality which are at the foundation of this institution. Our attention should be directed to affecting national policy so that ROTC scholarship eligibility encompasses all talented people who might choose to attend MIT. . . . Our consideration of the MIT-ROTC partnership is underway already." □

MIT Tops List of Engineering Grad Schools

The first annual U.S. News & World Report evaluation of graduate schools in the United States, released in March, ranks MIT first among graduate programs in engineering, followed by Stanford, the University of Illinois at Urbana-Champaign, the California Institute of Technology, and the University of California at Berkeley. Ranked by engineering department, MIT was first in aerospace, chemical, computer [science], materials & metallurgical, mechanical, and nuclear. It was second in electric/electronic, and third in biomedical and civil.

In the business school category, MIT placed fifth, after Stanford, Harvard, the University of Pennsylvania, and Northwestern. In the subcategories of "Best Business Schools by Department," MIT was first in business information systems and in production management, and fourth in finance.

While this is its first ranking of grad schools, U.S. News has for some years now provided an evaluation of undergraduate institutions. While cautioning that the schools ranking highest "do not exercise a monopoly on quality education," the magazine said that "nevertheless, institutional reputations matter; in some professions they may be crucial. Fairly or unfairly, the value of a degree from that institution depends in part on those perceptions." □



ALUM. NEWS

Moving Research into the Market

For its first 125 years, MIT often pushed the entrepreneurs it hatched out of the nest. Ken Olsen, '50, left MIT Lincoln Labs to start Digital Equipment Corp. because "nobody [at MIT] cared" about his plan for building small laboratory computers. Armed with a copy of Samuelson's *Economics*, he ap-

proached the venture capital firm of American Research and Development on his own to get the \$70,000 seed money for Digital.

While he was a researcher in the Artificial Intelligence Laboratory, Danny Hillis, '78, got tired of waiting for the old MIT Patent Office to act and secured key patents for parallel-processing techniques by himself. Then he left to found Thinking Machines Corp. with outside venture capital. As for licensing MIT inventions to outsiders, "the rap used to

be that the lawyers in [the Patent Office] would find lots of ways to kill those deals," remembers Bill Kosinar '66, an investment banker with Furman Selz and a member of the executive committee of the MIT Enterprise Forum of New York.

No more. Thanks to the fact that technology transfer has gained favor with the federal government and become a high priority at MIT, the lawyers are gone. The Patent Office was renamed the Technology Licensing

Office (TLO), and is now staffed entirely by "accelerators"—former entrepreneurs and business people with technical backgrounds—and the legal work is farmed out to local firms. New York alumni/ae are among several groups of MIT graduates who have heard about the changes directly from TLO Director John Preston, himself a co-founder of two companies. Preston was one of the panelists addressing the topic, "University Technology Transfer: How A Pro



Young alumni/ae in the Boston area performed their first community service project in December 1989, but the effort was so rewarding they know they will be doing it again. Eighteen alumni/ae and friends spent a Saturday refurbishing a playroom at

My Sister's Place, a daytime center in the South End that provides services for homeless women and their children. They had the satisfaction of hearing the enthusiastic response of some of the children to the renovated play and storage structure and to the freshly

painted playroom—including a wall mural the group designed. Arranged around the play structure are, left to right (front): Edward Shoucair, MCP '84; Marsha Cohen; Teri Russo, coordinator of the program at My Sister's Place; Jane Grussing, Alumni/ae Association;

Alison Lueders, SM '84; Erin Hester, '82; Simon Mok, '85; Don McGowan, PhD '82. (Back): John Canfield, '87; Brett Miwa, '86; Marc Duivivier; Tara Murphy; Dan Money, '87, and Craig Whitaker, MAR '83.

Picks The Winners," at a fall '89 meeting of the MIT Enterprise Forum of New York.

Since the restaffing in 1986, the office has licensed over 200 patents, approximately 20 of them to start-up companies created and seeded by MIT. An example is Matritech, a Cambridge, Mass., biotech start-up that now employs 25 people and is rolling out a new test for detecting cancer based on antibody research by Biology Professor Sheldon Penman. And American Superconductor Co. in Woburn, Mass., was formed by Materials Science Professors Gregory Yurek and John Vandersande to exploit MIT research in high-temperature superconductors. The average initial investment in such companies was \$2 million in 1988.

The office currently has 5,000 inventions on file, on which 1,500 patents have been issued. Preston advises investors who want to tap into that cache to "take a TLO officer to lunch."

MIT currently owns between \$6 and \$7 million worth of equity in young spinoff companies. None is mature enough to yield a jackpot for the Institute and its inventors, and some will undoubtedly become casualties in the current high-tech recession in Massachusetts. But the lure of the jackpot is tantalizing: the University of Florida reaps millions from one invention—Gatorade. Similarly, Stanford gets hefty royalties from the original gene-splicing patent. MIT license agreements, whether with spin-offs or established companies, are negotiated with the idea that it's better to have a 2 percent royalty from the next Genentech than an

8 percent royalty from a company that has a smaller chance of succeeding.

Licensing fees and royalties aside, MIT wants to place its innovations in the hands of businesses that have the best chance of turning those innovations into jobs and useful products. How to determine the chance of success? Preston and his staff rate possible licensing deals along three dimensions:

- Quality of the innovation itself. Is it a breakthrough or merely an incremental improvement? How many follow-on products can be squeezed out of it? How difficult will it be for competitors to reverse engineer it?

- Quality of the receiving management. Does the team include experts with proven track records in finance, production, inventory, and "realistic" marketing?

- Quality of the source of capital. Is there a high-level "sponsor," such as the CEO of a potential licensee or a venture capital firm, who will smooth the way for additional funds? Do the backers have experience hiring and coaching executives? Do they have connections to potential suppliers, joint venture partners, and customers? Does the potential licensee already have access to the market?

Those are just the objective components. Preston emphasizes that deals rise or fall on two "gut level" qualities: image and passion. Image means market appeal, credibility, the smell of success, and either the inventor or the licensee can contribute to it. In some fields, the MIT name adds significantly to image. If a key researcher is a member of the National Academy of

Sciences or has won the Nobel Prize, that can be a big plus. In software, having IBM as the first licensee confers extra credibility.

In Preston's lexicon, passion means an inventor determined to overcome all hurdles to bring the product to market. "It's bad if the researcher says, 'Here's my invention. I'm working in a different field [now], but see if you can make some money for me.' If they just mail it in without coming to see us, that's even worse. Because when the CEO of Merck or Pfizer comes in, he wants to hear [the inventory say] 'I'm going to make it happen, come hell or high water.'"

TLO effectiveness in getting new technology into the marketplace is winning support from faculty, who filed one-third more patent disclosures in 1989 than in the previous year. One-third of the royalties go to the inventors, 15 percent go to TLO to cover overhead, and the rest go into departmental and general funds.

Some participating faculty members leave MIT to become officers in start-ups, but most remain at the Institute, doing basic research that is crucial to the licensees' success. "In biotechnology, you cannot do research, development, and product distribution with just one company," says Matritech's president, Stephen Chubb. "Penman does the research at MIT, we do the development, and product distribution will take care of itself if research and development are first-rate."—Diana ben Aaron, '85 □

The author is a research analyst at The Research Board in New York City.

CALENDAR

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New Life for an Old Club: A Miami Tale

Members of the Alumni/ae Association staff are hoping that the recent success in the Miami area will serve as an inspiration to graduates in many centers that now lack a thriving MIT alumni club.

There had been a club in Miami since 1937, but by the mid-'80s, its activity level had quietly faded out. Meanwhile, the business climate in the surrounding area was changing: there has been substantial growth in the number of young professionals successfully plying their trades in Miami. The potential for a lively club program seemed better than ever.

In the spring of 1988, Alumni/ae Association Gulf/Atlantic Regional Director Lou Alexander circulated a questionnaire to some 400 graduates in Dade and Broward Counties. The responses identified activities of interest to the local MIT community and about half a dozen people willing to

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form an organizing committee to help plan a modest program for 1989—three events, coordinated from Cambridge.

Turnout for events like a presentation on the *Voyager* space mission, held jointly with alumni/ae from Palm Beach and Fort Lauderdale, and a Bach symposium, organized by the local Wellesley alumnae club, inspired Alexander and the local organizing committee to go to the next step: a new board of directors and officers.

In October 1989, Paul Gluck, '68, hosted (and served as chef for) a festive cocktail party at his home that drew 100 grads and guests for the official launch of the new, revitalized MIT Club of Miami. That was followed in November with a newsletter that pulled in 60 paid memberships. Members received a directory of Miami alumni/ae and were invited to one locally organized event per month between January and May of

this year. One of the most successful programs was a talk by John Preston, director of the MIT Technology Licensing Office (see article on the TLO in this section). About 80 members of the club and the local business community, including the local business press, turned out to hear Preston talk about the way MIT interacts with entrepreneurs.

Alumni/ae of the Ivy League universities are active in the Miami area, and the MIT club structure provides an avenue through which Institute grads can plug into that network. In December, for example, Miami area students attending MIT and the Ivys were invited to a meeting with Miami business leaders designed to show them that there are rewarding career opportunities for them in Miami after graduation.

Six to eight events are being planned by the club for 1990-91, and everybody involved in the program is feeling very good about the resurgence of alumni/ae activity in the Miami area in the past year and a half.

The lessons of Miami have not been lost on alumni/ae in New Orleans, where the MIT club has been inactive since 1982. In late 1989, Alan Katz, '75, called Lou Alexander and said "let's do something." A reception in January with Alumni/ae Association President Harris Weinstein, '56, drew 30 people—an outstanding turnout considering there are only about 160 MIT graduates in the area—and virtually everyone who came was enthusiastic and offered to work. Last we heard, Alexander was preparing a questionnaire to assess local interests and identify potential club leadership. . . . □

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**MIT
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Giving the Noble Trees a Second Life

Once beyond the trendy

boutiques of historic New Hope, Pa., it is a mile and a half through hilly woodlands to the turn onto Aquetong Road, then another half-mile to a cluster of low buildings and an easily missed sign announcing

the establishment of George Nakashima, woodworker. Open for visitors on Saturdays, 1 to 4:30.

Gravel driveways and stone paths connect the buildings, which are interspersed with Japanese gardens. An orchard is visible lower down the slope. It is difficult to locate an office, and the quiet belies the fact that these buildings house a business with 12 employees, two years of back orders, and customers and suppliers around the world.

George Nakashima, MAR '30, was the first person to be named a National Living Treasure by the American Craft Council, and his unique furniture is owned by the Metropolitan Museum of Art in New York, the Museum of Fine Arts in Boston, and some of the country's most discriminating collectors. When more than 100 pieces of Nakashima furniture burned along with the home of Arthur and Evelyn Krosnick in Princeton, N.J., last year, the blaze warranted coverage in the *New York Times* and



BY SUSAN LEWIS

in his 80s in a kimono-style jacket, he introduces us to his family. His wife, Marion, has handled the business's books since the mid-1940s, when Nakashima was making each piece himself in an unheated, open garage. His daughter, Mira Nakashima-Yarnall, studied architecture at Harvard and Tokyo's Waseda University and now works with her father on design and production. Son Kevin involves himself in the business end of the enterprise, and we later meet Mira's husband, Jonathan, at work in the chair shop. Even one of Mira's children is showing some interest in his grandfather's craft.

George and Kevin take us on a tour of the compound, an island of Japanese architecture and landscaping in the middle of the Bucks County woods. This idyllic setting is, we gradually realize, the product of years of spectacularly hard work. The senior Nakashimas cleared the land on their original three-acre site, still live in the house (now slightly

prompted a full-page article in *Time* magazine. Those articles inspired photographer Barry Hetherington and me to visit what has become something of a shrine for admirers of American woodworking.

When we find Nakashima, a quiet, intense man

enlarged) that they built with scrounged materials and local stone in 1948, planted the orchard and built the stone walls that ramble around the grounds, and slowly added to their business and living complex without ever taking out a mortgage.

Although all but the most utilitarian buildings have a Japanese character, not all are traditional construction. Nakashima's training in architecture can be seen in the beautiful lines and structural inventiveness of the "Conoid Studio," completed in 1957. Like the geometric form for which it is named, one side rises in an arch, the op-



posite side is a low rectangle, and between the sides extends a rounded plane of roof, 40 feet by 40 feet. That roof is a shell of poured concrete two and a half inches thick, supported only by a stone wall at the back and the concrete arch at the front. It is a construction method that takes tremendous know-how on the part of the builder but only half the materials required by a more conventional roof of that size.

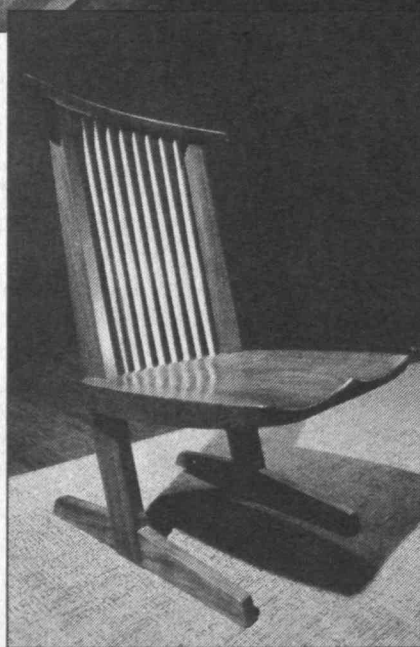
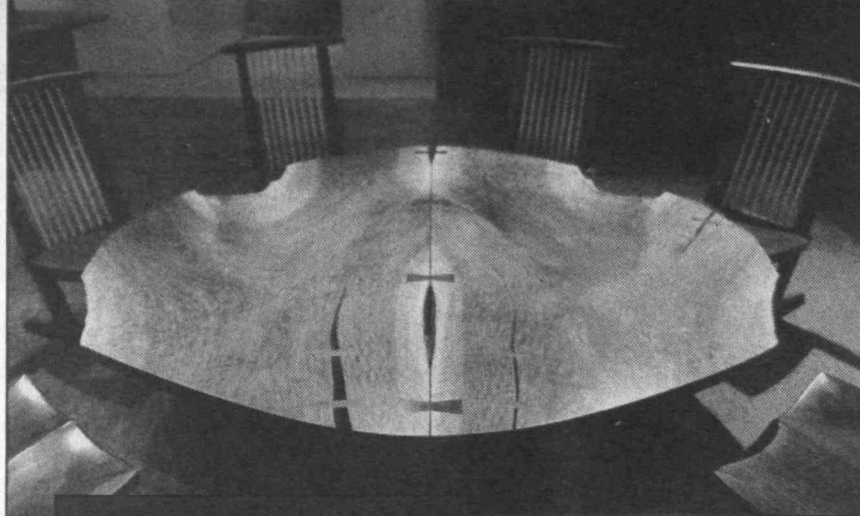
As we walk from building to building, we pass stacks of wood everywhere, most in "boule" form—a long section of trunk sliced lengthwise into one- to four-inch slabs and stacked together in the or-

der they were cut. Nakashima seems to have a personal relationship with almost every board. "This piece of Indian rosewood," Nakashima tells me, "was returned to the owner when the dealer couldn't sell it. Eventually the price came down to what I could afford." About another, he remembers, "This log I bought from a young Polish logger; he was after this tree for 10 years before he finally acquired it."

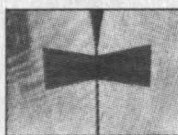
The history that is really important to Nakashima, however, is that of the trees from which the logs come. What species, what country of origin, what fire and drought and flood stressed the wood; what bo-

tanical flight of fancy prompted the tree to produce its dramatically figured burls; what generations of sunlight and rich soil allowed it to gain three, four, five feet in diameter before it finally died? In his autobiography, *The Soul of A Tree*, Nakashima describes the experiences of the living tree that will later be visible in the wood—but only to the trained eye.

In the natural course of events, a dead tree will ultimately be felled by storm or lightning; once lying on the ground, it will decay to humus. By cutting the tree when dead or near-dead, sawing it into lumber, air drying the planks for two years, and



The quintessential Nakashima grouping, exhibiting several of his trademarks: table topped by two book-matched boards, their outside edges left unsawn, or "free;" contrasting butterfly keys join the boards and span the natural flaws in the wood; "Conoid chairs" with single-board seats.



making them into furniture crafted to endure, Nakashima sees himself extending the life of a noble tree for several hundred years. For him, being a woodworker is as much a religious act as a job. And this family enterprise is the embodiment, the integration, of all the experiences he had before he began building furniture in New Hope more than 45 years ago.

Nakashima was born to Japanese parents in Spokane, Wash., and it was on mountain hikes in the Pacific Northwest that he first acquired his reverence for trees. After he earned a bachelor's degree in architecture at the University of Washington, the local Japanese community put together a scholarship fund to pay his way to Harvard. But he says he was put off by what he experienced as the

"snobbery" of that school, so he "walked down the street to MIT." There he met William Emerson, head of the Architecture Department and later MIT's first dean of architecture. Things were simpler in 1929: Emerson accepted Nakashima into the master's program and agreed to his request for a scholarship on the spot.

Three years after receiving the degree, Nakashima traveled to London and Paris on his way to Japan. It was the first leg of a seven-year world journey that took him from Chartres Cathedral to the architectural monuments of Japan—a set of experiences that is still part of his everyday conversation. In Japan, he went to work for the architectural firm of Antonin Raymond, who came to Japan as an assistant to Frank Lloyd Wright, architect for the Imperial Hotel in Tokyo. Na-

kashima accepted an assignment from Raymond's company to supervise the design and construction of a dormitory at the ashram of Sri Aurobindo in Pondicherry, India.

Profoundly influenced by Sri Aurobindo's teachings, Nakashima stayed two years in India. He seriously considered spending the rest of his life at the ashram, but decided instead that he would pursue his spiritual values in the world, practicing the "yoga of action" rather than a purely meditative path. His resumption of architectural work in Japan didn't last long, however; the approach of war in Asia prompted him and Marion, then teaching English in Tokyo, to return to the United States in 1940.

Nakashima prepared himself to work here with an architectural tour of the West Coast that included several buildings by Wright. Nakashima found the level of craftsmanship in the States much lower than that in Japan or even India, and he couldn't imagine himself working as an architect under those circumstances. Becoming an independent craftsman who controlled his own work from start to finish seemed like a good alternative, and he opened his first workshop in Seattle.

In 1944, Nakashima, Marion, and the infant Mira were among thousands of Japanese-Americans (and Japanese-Canadians) interned in camps on the assumption that they posed a threat to national security. It was in a camp in Minidoka, Idaho, that Nakashima entered the final phase of preparation for his life's work—he became designer for and apprentice to a similarly incarcerated, Japan-trained woodworker. They made furniture with whatever scraps of wood they could find. By the time Antonin Raymond sponsored the family's release from the camp and gave them a place to live on his farm in Pennsylvania, Nakashima had learned to use classic Japanese tools and joinery and was thoroughly steeped in the Japanese reverence for materials.

After a year as a laborer on Ray-

mond's farm, Nakashima struck out on his own, renting a small house and setting up a shop in the garage. He procured his wood from local suppliers, often tramping the woods to find the trees he wanted, and launched a stream of new designs at a rate of about one per year.

His success as a designer ultimately allowed Nakashima to purchase exotic woods from around the world, and their use became one of his trademarks. A particularly tragic aspect of the afore-mentioned fire at the Krosnick's home was that much of the furniture was of irreplaceable materials—Indian rosewood, for example, can no longer be exported from India.

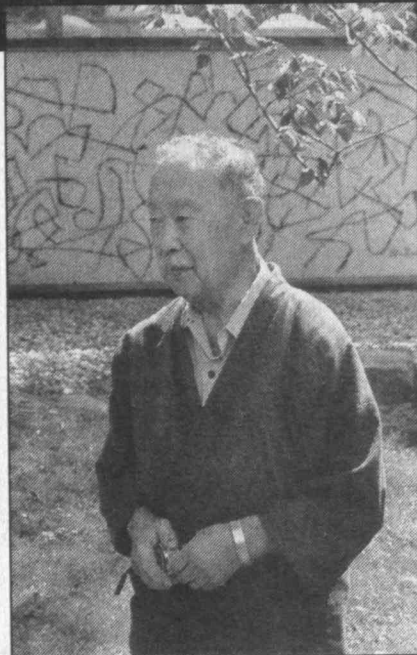
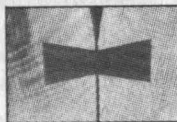
If one had to point to a single characteristic that makes Nakashima's work extraordinary, it's his use of the "free edge." Instead of sawing and planing boards into uniform widths, he designs many pieces that have one or more board edges left just as the tree shaped them. Only the bark is removed and the edge is sanded.

Letting the shape of a piece be determined by the wood reflects his conviction that the highest expressions of human design and craftsmanship—such as the bowls for the Japanese tea ceremony—are not manifestations of the ego of the designer or the craftsman; rather, they exhibit respect for the materials and the use for which the piece is intended. And like Chartres Cathedral, the high point of Western civilization in Nakashima's eyes, the best design is anonymous. Indeed, until his customers began insisting, Nakashima did not sign his furniture.

Another Nakashima specialty is the tabletop of "book-matched" boards that rest on architectonic bases rather than legs. Book-matched refers to two adjacent boards cut from one tree, fastened at one edge, then "opened" like the pages of a book to form a flat surface, with the outside edges left free. Nakashima's Altar for Peace at the Cathedral of St. John the Divine in



Jim Radcliffe (above) was 14 years old when he started sweeping floors and helping with sanding. Now, 35 years later, he executes Nakashima's tables and cabinets. Nakashima (right) treasured his friendship with artist Ben Shahn, who designed the mosaic on George's Minguren Museum.



New York City, 10 and a half feet on a side, is crafted of book-matched boards of English walnut.

As his work matured, Nakashima looked more often for wood that other craftspeople would discard—roots or wood with knots and splits that have unique character. He spends a lot of time thinking about how to incorporate the features of a particular board into a piece of furniture, finding ways of making flaws into assets.

Another cannon of Nakashima's faith is that the finish must not interfere with the character of the wood; he prescribes an oil finish. He has been known to turn down commissions from people whose taste for polyurethane indicates that "they shouldn't have my furniture."

The fact that he considers himself a craftsman rather than an artist has won Nakashima no less respect

from artists. The late painter Ben Shahn was a frequent visitor to Aquetong Road, and he created a mosaic for the wall of Nakashima's Minguren Museum (a small museum dedicated to wood). Georgia O'Keeffe often visited the construction site of the monastery outside Sante Fe, N.M., that Nakashima designed and built in 1972 with local materials and local craftspeople.

Different as they are in the style and pattern of their lives—one working with lumber in the woods of Pennsylvania, the other a technological innovator happiest in his laboratory under the Great Dome—Nakashima reminds me of Doc Edgerton. Doc, like Nakashima, was engaged in his work with the whole force of his personality and intellect, and he never really retired. Examples of the fully integrated life, both of them. □

This Dog Made MIT a Better Place for People

Beau Moriarty died on March 3. He was well known around the Institute, especially in some of his favorite subjects, including 6.041, 18.03, and 18.01. Beau also worked closely with members of the Department of Electrical Engineering in Building 35.

Beau was a golden retriever.

Beau's owner, Ed Moriarty, '76, said that his sister brought the dog up from Washington, D.C., several years ago, just as Ed was starting out as a faculty liaison for Project Athena. Beau's previous owners had been looking for a golden retriever to play with the kids. According to Ed, Beau "wasn't that kind of dog."

Ed agreed to keep the dog, but this immediately became a problem when Ed found himself in between apartments for a month. He had no place to leave Beau during the day, "So I just started bringing him to work with me."

Almost immediately, Beau became better known than Ed. "Everyone always said hi to Beau. No one ever said hi to me!" he remembered. "Crossing campus took a long time with Beau. Everyone always wanted to stop and see him." Years later, Ed is convinced, "home" for Beau was not the Moriartys' favorite vacation spot in Maine, nor their Belmont apartment; it was MIT.

The dog smoothed the rough edges of Ed's day. "One of the complaints people had . . . was that nobody could yell at me. They'd come into a room, say hi to Beau, pet him, and then they had no choice but to be civil to me."

Once, Beau followed a group of people out of a room in Building 4 where Ed was working, unaware that Ed had stayed behind. When Ed realized the dog was missing, he went looking for him, covering most of the main Institute buildings. Then a man walked up to him and asked, "Are you looking for Beau? He was in the basement of Building 10 half an hour ago, heading toward Mass. Ave." Ed had no idea who the man was or how he knew Beau—but it wasn't the first time a complete stranger showed a real interest in Beau's whereabouts. On this occasion, Ed eventually found Beau in Building 35, eating pizza with some graduate students.

Ed and his colleagues are full of stories about Beau, like the time he cleared a conference room with a sudden attack of gas, or the many times he sat in 6.041 lectures and paid more attention than



Ed Moriarty, '76, and Beau

the students. Ed would be there to observe for his project, and Beau, of course, would follow. In his early years "he would just watch that lecturer, back and forth, like a tennis match," Ed says. As Beau got older, he had heard it all before and just slept through the lectures like the rest of us.

Ed said that Beau was an intellectual, a Cambridge dog unfit for playing or fetching. (The only time he ever caught a squirrel, it was by accident.) Ed told people that Beau had earned his dogtorate. "I guess now he's a post-dog," he said with a little smile.

The many secretaries and administrators in the Institute with Milk-Bone stashes in their desks have been saddened by the loss of Beau, and the Laboratory for Computer Science softball team has lost its official bat dog.

"That's why I keep coming back here," said Moriarty, who graduated from the mechanical engineering department in 1976, returned for some graduate work, and now works with the electrical engineering and math departments on courseware. "MIT always has a real feeling of family. Of course, because of Beau, people may have been more friendly to me than most."

You don't have to know Ed Moriarty for very long to see how special Beau was to him. "Friends, you have a certain part of the day. Family, you have a certain part of the day. Beau was *always* there," Ed told me with considerable emotion. "People can talk—that's a real limitation. Dogs just know. They communicate things we can't say in words."

Beau had been ill for some time. Golden retrievers have been seriously inbred, and are prey to a number of health problems, Ed explained. "I sat down last Saturday with Beau on my lap and fed him some turkey (his favorite). I knew that I was taking him to the vet at noon, and that would be it."

"I asked the vet if I could give him the injection. The vet was a little surprised at this, but Beau and I could handle it. We had shared so much in our lives, I couldn't have had someone else do it."

Why all the fuss over a dog, you ask? Because of one thing Ed Moriarty said to me: "When someone would be walking around here in a daze, suddenly I would walk by them with Beau, and they would snap out of it. They would become human again." Anyone that can humanize MIT like that deserves to be remembered.

Beau Moriarty died peacefully on March 3, with his family by his side and his belly full of turkey. He is survived by Emily, Alix, Peter, Ed, and all of his MIT family and friends. □

—BILL JACKSON just completed his freshman year. He is a writer for The Tech, where this column first appeared. Jackson was in The Tech office the day Ed Moriarty tried to place an ad notifying Beau's many friends of his death. "I couldn't walk anywhere at any time of the day, couldn't even walk to my car at 8 o'clock at night, without someone, maybe several people, coming up and asking 'where is Beau?' It was getting to me; I wanted to notify everyone at once," Ed said later. But The Tech has a policy against accepting display ads from individuals. Bill Jackson heard Ed's discussion with the advertising department, followed him out of the office and asked to talk about Beau. Jackson's article "turned a miserable situation into something I can smile about," Moriarty said, and it prompted a barrage of affectionate notes of sympathy, some signed by whole departments, many from people he did not know.—Editor

UROP at 20

In the 20 years that have passed since MIT began its Undergraduate Research Opportunities Program (UROP), countless students and faculty have benefited from its unique format and innovative educational strategies. For many students, UROP is one of the most important factors in their decision to attend MIT; for others, it becomes a powerful incentive for staying at MIT through graduate and professional careers.

UROP is currently estimated to be in its third or fourth generation—that is, of UROP alumni/ae who become faculty with UROP students of their own. These layers give UROP the advantage of experience. Faculty members who were themselves UROP students often credit the program with their successes at MIT and in science.

Although MIT is considered a research institution, there is little opportunity for undergraduates to gain hands-on research experience outside of UROP. The chance to work with a team of researchers provides students with the kind of inside information they need to make decisions about their future in science. Says Assistant Professor of Brain & Cognitive Sciences Ellen Hildreth, '77, "MIT is a research-oriented place. UROP helps you decide if research is what you really want and allows you to make contact with those you might work with in graduate school." This, she explains, was different from the rest of her MIT experience. "I had no other exposure to research, no sense of what it was all about. I would have arrived at grad school with no real preparation."

For Associate Professor of Materials Science Yet-Ming Chiang, '80, who came to MIT at age 18 and never left, UROP resolved his un-



Dean Margaret MacVicar (left) and Assistant Dean Jane Sherwin cut the UROP birthday cake.

certainities about the future, which had arisen after a disappointing summer job. "I enjoyed research so much I decided to stay [the following] summers. It was pretty clear to me that this was what I wanted to do," he says, adding that for many students, UROP work is "the first time they can do something related to a career."

Another important facet of UROP is that it gives students a glimpse of academic life and allows them to put themselves into that picture. Associate Professor of Physics Bob LeDoux, '78, describes this feeling: "You see scientists doing their research in exactly the environment you would do it in later on." The lesson is as valuable for those who don't enjoy it as for those who do. "UROP taught me I didn't want to do lab research," declares Beth Marcus, '79, who runs her own robotics start-up company in Burlington, Mass. Still, her UROP work on motion sickness in space led her to a

summer job with NASA (and almost into space as an astronaut). Today, although not directly involved with her UROP material, she still does some work with NASA and has been able to draw upon the specialized work she did with her project.

While advance career planning is a significant benefit of UROP participation, many of its rewards are more immediate in nature. The chance to work with faculty members on a more personal, intimate level can provide a welcome alternative to the monolithic quality of the Institute. For many, says Chiang, it is "the first time there are not 100 other students doing the same thing." LeDoux, noting that a typical faculty-student ratio in laboratory classes is 1:20, says that the environment of the UROP lab allows one "to see the problems but also some of the rewards of life as a professor."

For Marcus, the program allowed her "to meet professors on a much more equal footing." She says that through UROP "you become much less frightened of [professors] and realize they're normal human beings and that you could be [a professor] too!" The academic relationship between Chiang and his faculty supervisor (W. David Kingery, now a professor at the University of Arizona) was especially strong. "I really connected with my supervisor," Chiang remembers, "and decided to write a thesis rather than do a co-op, [although the latter] would have been much more financially rewarding."

Similarly, the opportunity to meet graduate students at different points in their degree work can open up new worlds of information. LeDoux sees graduate students as providing "great exposure to a school. When you meet grad students and work intimately with them, you know the inside scoop on the institution." Recalls Marcus: "There were quite a

LESLIE JEFFS, a 1989 graduate of Williams College, is a free-lance writer based in Cambridge.

few grad students on the project. We would all sit around and talk . . . I learned a lot through their experiences." These types of friendships, unusual at MIT in general, provide access to a variety of views and stages in the academic life-cycle.

Occasionally, UROP will bring the student into contact with important researchers outside of the MIT community. Associate Professor of EECS David Gifford, '76, praised UROP for giving him the "opportunity to work with a collection of really first-class people. I worked [particularly] closely with one of MIT's industrial partners, Honeywell, where I made professional associations that are still with me." Through a faculty member connected to her initial UROP project, Ellen Hildreth was able to learn about developments in human vision research. Hildreth, who earned her undergraduate degree in mathematics, eventually pursued this second option and was able to take advantage of her inside information when she changed fields.

There are many other fringe benefits to UROP work. Frequently mentioned is the opportunity to publish journal papers and attend conferences. Gifford's project sent him to his first conference and "permitted me to do an original piece of work in my junior year that ultimately was good enough to win a student paper award. In addition, this work provided a platform for me to get into good graduate schools and to get funding." Yet-Ming Chiang's work over his junior year took him as far as Texas to conduct research and eventually led to the publishing of his first journal paper.

Besides such ego-boosting perks, UROP students can benefit from more effective letters of recommendation. "The close interaction gives the faculty member a better idea of your skills, so that [he or she] can write a stronger letter with more in-depth information," says Hildreth.

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LeDoux also feels quite strongly about the advantages of UROP-based recommendations. "Virtues you can see in a UROP student—motivation, enthusiasm, creativity in addressing problems—can set him or her apart from a strictly all-A's student. These are the qualities that really push a field forward, and which are much more difficult to identify in classroom work."

Assistant Professor of Strategic Management Rebecca Henderson, '81, cites another positive result: "Participating in UROP probably raised my grades," she claims. "It made my courses much more enjoyable and exciting. UROP was very real—it made the undergraduate degree much more fun and worthwhile." Working with Seymour Papert, now the LEGO Professor of Learning Research, to develop an educational computer environment for handicapped children, Ellen Hildreth also found that the UROP experience helped her academic performance. "You get a better sense of where you want to go. UROP helps motivate you in coursework, and you make wiser decisions about subjects." LeDoux adds that for UROP students, "egos go way up. Students are at best considered

average here [at MIT]. In UROP, they can excel and gain confidence."

Perhaps the least tangible yet most significant contribution UROP makes to the MIT community is the way it changes the very essence of learning. Polaroid founder Edwin Land, who first outlined the ideas behind UROP in a speech to the MIT community in 1957, wanted to create an educational model that would preserve individual creativity and challenge young minds to greatness. His ideals appear to have been realized in UROP. The kind of learning the program encourages is qualitatively different from the rote memorization and problem-set solving typical of many science subjects.

One of the key elements UROP introduces into the curriculum is risk. Says Chiang, "This is often the first time [students] tackle something to which they are not sure there is an answer." Henderson describes classes as "much more passive" than UROP work. Students ordinarily avoid risk, declares Associate Professor of Aeronautics and Astronautics Ed Crawley, '76, whose UROP supervisor was Professor Eugene Covert, ScD '58. "Although the risk of UROP is somewhat artificial—you won't be fired if you make a mistake—the risk seems real." Crawley worked on the first human-powered aircraft at MIT, BURD I (which predated UROP) and BURD II. The airplanes never flew, but did lead to more successful offspring. He observes that UROP "can teach you that there is some good and useful application for what you're learning. You learn how to apply what you've learned to the real world." The learning of UROP, Crawley jokes, "is often learning by stumbling and falling."

"Initiative, enthusiasm, and hard work make the difference," explains LeDoux. "Other abilities besides pure intellect can shine through.

You really learn that science is not a textbook, and that most ideas don't work. *Insight* is the most important component of a successful scientist—picking the right questions and trying to answer them. You have to learn to be adaptable. Most of the time you have to work with partial knowledge; you must live with the fact that you don't know everything. This situation is totally different from the classroom, where you believe you must understand everything in order to get the answer."

The UROP experience has as many variations as participants, and that flexibility is its most precious quality. Decidedly anti-bureaucratic, it puts the control into the stu-

dent's hands. Jane Sherwin, assistant dean for undergraduate research, explains that UROP has "very few walls. It is an program which opens things up—rare in such a big place." A UROP project can be "as much or as little as you want to make it. You can wash test tubes or show them you've got some initiative," says Marcus. David Gifford compares a UROP project to an entrepreneurial venture: "The more you put into it, the more you get out of it. . . . UROP gives you responsibility and education not available through any other channel."

As faculty supervisors, these ex-UROPers appreciate the same flexibility. "You can use UROP students in different ways and find projects

appropriate to the individual," comments LeDoux. Crawley, who has supervised approximately 200 UROP students over the past five years, estimates that "out of these 200, less than 20 have been truly entrepreneurial." For these 20, however, the sky has been the limit. And for the other 180, UROP provided them with challenges of their own and important educational benefits.

The words of Bob LeDoux perhaps sum it up best: "There are many other institutions which can give you a comparable education in classwork and labs, but UROP is fairly unique. It makes the difference between going to MIT and going elsewhere; it pushes MIT to the top of the list." □



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CLASS NOTES

18

I am very grateful to **Herbert Hatch** for his newsy letter. He writes from the Clover Living Center in Auburn, Maine: "How fortunate you are to be able to step out your front door and go to meetings at MIT or shopping in Boston! I do envy you. As my two children are both located in Maine, they persuaded me to sell my home in Wollaston and locate in this living center where everything is done for us. I am still healthy and get out to walk every day; I'll be 95 April 13.

"I note in the April *Review* that George Crowell, '16, of Brockton, Mass., fell and broke his wrist; that and broken legs seem to be the most common problems of aging. Mrs. Hatch has had many falls and suffered a broken hip, which (together with her being legally blind) requires that she be put into the nursing home section at the opposite end of the building.

"I discovered that Stanley Bragdon, '19, is also a tenant here and that we graduated the same day in June 1920. We are often taken out together on evening lectures or movies. I admit my delinquency in not writing before, but what interest is there in the doings of a home for the elderly?"

It would be wonderful if some of you would follow Herbert's example and send what news you can.

Several welcome letters have been received from **Herb Lerner** telling of his activities in defending abortion rights, including public discussion of AIDS.—**Max Seltzer**, secretary, 856 Central Ave., Needham, MA

19

I am happy to pass on to you some good news. I had some eye surgery and now can again read and write. I shall resume my duty to the class with the 1919 column. Perhaps you, too, have some good news about yourself to pass on to me for the *Review*.

I am a little late in advising you of the death on April 20, 1989, of our classmate **John M. Erving**. His wife, Ruth, notified the MIT Alumni/ae Association of his passing. In a later column, I will provide more information about his career. I personally recall him during our days at school and shall miss him from our midst.

I look forward to hearing from you and, meantime, wish you a lovely summer.—**W.O. Langille**, secretary, P.O. Box 144, Gladstone, NY 06934

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At our special table for the Technology Day luncheon in June, we shall hope for a representative number of classmates. Details about this event will be noted in a later issue. Our class agents for the Alumni/ae Fund are no longer with us, but their long and faithful service deserve to be recognized. We salute them: **Al Burke** and **Perk Bugbee**. Al is survived by a son who lives in West Hills, Calif., and Perk by two sons and a

daughter. **John Lynch** died recently in Centerville. He was long with the Grayber Electrical Co. and lived in West Palm Beach, Fla., until he moved to Centerville. He is survived by a son, two daughters, grandchildren, and great-grandchildren.

We must also report the death of **Albert Demmler** of New Kensington, Pa. He was a metallurgist who became director of metallurgy and research for the Campbell Foundry. He is survived by a son.—**Harold Bugbee**, secretary, 3 Rehabilitation, Woburn, MA 01801

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I am indebted to **Cac Clarke** for sending me a clipping from the *New York Times*, covering the death of **Francis L. Blewer** of New York City on February 23, 1990.

After graduation, Frank started his career with Harris, Forbes & Co., a leading bond house. He later moved to W.E. Burnnet & Co., members of the New York Stock Exchange, and became a partner two years later. In 1942, he joined the U.S. Army, first in the Officer Procurement Corps, then as a financial officer of the General Staff in Washington. He was separated from the Army as lieutenant colonel and returned to W.E. Burnnet where he was made senior partner and subsequently managing partner.

Your secretary remembers Frank as a fellow resident of Runkle Hall in undergraduate days.—**Sumner Hayward**, secretary, Wellspring House E64, Washington Ave. Ext., Albany, NY 12203; **Samuel E. Lunden**, assistant secretary, 6205 Via Colinita, Rancho Palos Verdes, CA 90274

22

Classmates may remember that **William B. Elmer** used to draw cartoons for *VooDoo* magazine. After graduation, Bill continued to supply *VooDoo* with drawings for about six years. *VooDoo's* present governing board learned of this and have added an 89-year-old member to their staff. The 1989 winter edition of *VooDoo* has a reprint of Bill's cat taken from the 1920 issue, and the 1988 winter edition has a two-page centerfold of Bill's drawing, "Beauty and the Beast," made for the 1929 volume but never, heretofore, published. To bring things up to date, the 1990 winter issue includes a full-page drawing, "Two Babes in Heaven." A letter to Bill from the *VooDoo* management says, "Our readers enjoy your work. The response has been very good. We are thrilled by your offer to let us photograph your collected works. The works of Elmer will continue to appear regularly. And we may even manage to publish a special anthology issue!" Now we can add an artist to our list of professionals still at work. In a letter to your secretary, Bill says that he is in good health, has 12 male descendants, and that he enjoys life more now overall than ever in the past, being "busy, busy, busy."

While not intending to boast, I am pleased to note that one of my grandsons has recently received his wings at the Army flying school at

Ft. Rucker, Ala.

The death of **Bertram A. Weber** on December 17, 1989, at his home in Pompano Beach, Fla., takes another very successful professional from our dwindling ranks. Bert, born in 1898, came to Tech as a sophomore after a year at Northwestern. He was a crack swimmer, being captain of the swimming team his senior year. His fraternity was Delta Tau Delta. Immediately after graduation, with an architectural degree, he co-founded White and Weber, Architects in Chicago. This firm evolved into Bertram A. Weber, Architects in 1936 and with his son into Weber and Weber in 1973. He retired in 1987. In his 64 years of practice in and about Chicago, he designed residences, commercial buildings, schools, hospitals, country clubs, libraries, public buildings, and other specialties. In 1958, he was elected fellow of the American Institute of Architects. He is survived by his wife, Dorothea, his son, John, and four grandchildren.

J. Warren Foster, Course XV, age 88, died December 6, 1989, at the Melrose Wakefield Hospital. He was a lifelong resident of Melrose, preparing for MIT at the Melrose High School. For over 40 years, he was a rate setter for the Boston and Maine Railroad. As far as I am aware, there are no immediate family survivors.

All of us who knew **Bert Weber** extend our condolences to his family.—**Yardley Chittick**, secretary, Rt. 1, Box 390, Ossipee, NH 03864

23

At this writing (mid April), the tail end of winter is appearing in southern New England. But winter has been tenacious. About four inches of snow fell early in April, but old "Sol" said "no" and it was all gone by the next afternoon. Tulip buds are showing but no flowers in my yard yet.

The effort at a mini-reunion in Florida did not work out and was called off. Your secretary received only one acceptance, **George Rowen** from West Hartford. George had his clubs all shined up and was raring to go. Sorry about that, George. Thinking about it, there can't be too many of us left in our class who can still lift a club, let alone swing it much. My wife, Winnie, only a few years younger than me, bowls Ten Pins and gets some pretty good scores. I can hardly lift the darn ball to carry it to the car, let alone bowl with it.

Announcements are out for Technology Day in June. Your secretary will probably not attend due mostly to a slight failing of eyesight that limits driving. I hope we have a good turnout.

News of affairs from classmates is meager. If you have anything you think would be of interest, tell me and I'll get it out.—**Frederick O.A. Almquist**, secretary/treasurer, 63 Wells Farm Dr., Wethersfield, CT 06109

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A letter from **Peter Littlefield** of Old Greenwich, Maine, informed MIT of the passing last Decem-

ber 21, of his father, **Prescott H. Littlefield** at age 88 in his home in Naples, Fla. Surviving are his wife, Margaret, of 60 years, daughter, a son, a sister, and four grandchildren. Our sympathy is extended to the family.

A long obituary from the *Philadelphia Inquirer* was sent to MIT informing us of the death of **George McFarland** last November 30 at age 86 in Haverford, Pa. Mr. McFarland had a varied and brilliant career. It began as an engineer for the Midvale Steel Co. of Philadelphia. He later worked for the Philadelphia-Reading Coal and Iron Co., where he was sales promotion manager, then as sales manager for McShain-Carrier Air Conditioning Co. of Philadelphia. Then he left the industry for a career in investment management and worked for Biddle-Whelen and Co. of Philadelphia.

During World War II, he joined the Navy as a reserve officer and earned the rank of commander. He returned to service during the Korean War. In 1946, he became a member of the board of managers of Philadelphia, Germantown and Norristown Railroad, of which his father, Elbridge McFarland, had been president. In 1971, he followed in his father's footsteps to the railroad's presidency. He was a 56-year life member of the Union League and a member of the league's Benson Table. He was a hereditary member of the St. Andrew's Society of Philadelphia. In that role, he established an annual scholarship fund to pay tuition for a college junior to study at the University of Edinburgh. He was also very active in civic and social organizations. He traveled extensively, taking trips throughout Europe, China, and the Soviet Union.

Surviving are his wife, Esther, a son, and a granddaughter—co-secretaries: **Katty Hereford**, Hacienda Carmel, No. 237, Carmel, CA 93921; **Col. I. Henry Stern**, 2840 S. Ocean, No. 514, Palm Beach, FL 33480

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Harold Robichau writes from his hometown of Beverly, Mass., to remind us that he has been retired from Stone & Webster for 21 years. Robie is confined to the house most of the time with leg problems. His good wife of 61 years, Florence, is still with him and they take life as it comes, one day at a time.

Since reporting the passing of **Ralph Gow**, much information has become available that may be of interest to classmates. Ralph joined the Norton Co. in Worcester, Mass., right after graduation, and except for about three years during World War II continued with the company until retirement. He was elected to the board of directors in 1947, became executive vice-president a year later, and was named president in 1961, serving until 1967 when he became vice-chair of the board. Ralph was the first president who was not a member of the company's founding families. During the war period, Ralph was a colonel in the Army General Staff Corps and was assigned to the office of the undersecretary of war, serving as chief of the industrial services and industrial personnel divisions. He was awarded the Distinguished Service Medal. Ralph was active in community affairs, belonging to a number of clubs and serving as trustee and president of several foundations and charitable organizations. He was a trustee of several schools and colleges, and served a term as member of the MIT Corporation. He was also a board member of many companies and banks.—**F. Leroy (Doc) Foster**, secretary, 434 Old Comers Rd., P.O. Box 331, North Chatham, MA 02650

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I had a chat with **Morris Minisk**, and we exchanged experiences. . . . I called our class president **Robert T. Dawes**, who is keeping his nose to the grindstone. Whereas his daughter is presi-

dent of the family company, Bob is at work every day as chair. He also chairs the local bank. He didn't mention retiring. . . . My wife, Mary is in the hospital recovering from an infection.

Reginald Terrill, of Bow, N. H., is performing a wonderful service for the children of his town. He has been selected the first runner-up in the second National School Volunteer Awards Program. He was chosen from over 1,000 nominees received from all 16,000 school districts nationwide. Reggie has worked with Bow students daily for the past 16 years in a carpentry program that he developed. He has logged over 7,000 hours of volunteer time in Bow schools. Weekly in his shop in the elementary school, each youngster in grades 1-4 completes two woodworking projects per year. Another classmate honors the class of 1926 and MIT.

Arnold R. Marshall left us January 12. He was a mechanical engineer for the Union Bag and Paper Co., and the Sandy Hill Iron and Brass Works, and later worked as an engineer for the Washington County Highway Dept. He lived in Hudson Falls, N.Y., and summered at Jupiter Point in Groton, Conn. He is survived by a son, two daughters, a sister, and seven grandchildren.—**Donald S. Cunningham**, secretary, 27 Lowell St., Braintree, MA 02184

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David R. Knox has fulfilled another goal. He has done what some may have started and many wish to accomplish—he has completed an autobiography, titled *My Swath of 20th Century Living*. On full-size pages, his wife Jean has beautifully typed David's story of a life full of experiences and accomplishments. In an epilogue he sites the numerous inventions of our lifetime that have changed life. From his memory of life in Great Barrington, Mass. (1903-1910), through his education at MIT, he recites his career with the Bundy Tubing Co. He was appointed manager of their Nine Mile Road Plant in Warren, Mich., which he held for five years. Then he became development engineer, followed by chief of facilities engineering. Dave retired in 1967. He has several patents connected with tubing and testing.

In 1964, Dave's late wife, Dorothy, had a stroke, which left her speechless. The struggle with this handicap changed both of their lives, and she lived with a mild speech impediment until June 1982. Dave's book *Portrait of Aphasia* has been acknowledged as a superb subjective account of this rare illness. Besides this, Dave became mayor of Huntington Woods, Mich., for four years, but of greater satisfaction has been his hobby of oil painting over the past 20 years. We extend him our sincere congratulations.

John J. Boyle of Milton, Mass., hit the jackpot. Having bought seven Megabucks tickets every week for years, he finally won \$2.3 million in 20 installments. A self-employed engineer all his life, John has been living in an elderly complex in Milton. We are sure he has plenty of advice on how to spend his pot.

William M. Crane, Jr., of Medfield, Mass., died December 29, 1989. He graduated from Harvard in 1924, and after MIT he was employed by the Anaconda American Brass Co. for 32 years. He became director of market research and retired in 1968. Typical of MIT men, he assisted his community of Waterbury, Conn. He was active in the United Way, the VNA, and the Boys Club of Waterbury. He joined the staff of the Visiting Nurse's Association and served until 1986. Our sympathy is extended to his family.—**Joseph C. Burley**, secretary, North River Rd., Epping, NH 03042; **Lawrence B. Grew**, assistant secretary, 21 Yowago Ave., Branford, CT 06504

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One of the pleasures privileged to old age is that of reminiscing into the far past and recalling

notable and special experiences. **George Chatfield** has sent in a copy of the old publicity piece he mailed out to the class over one-half century ago relative to our then approaching 10th reunion. George, even then in his youth, did a bang-up job on such assignments. The old flyer is covered with photographs and names of those planning to attend and shows an impressive view of Ye Castle Inn beckoning all to Cornfield Point, Saybrook, Conn. That three-day weekend party, for classmates only (stag), cost \$19.28 per person, and this covered everything except bar charges. The Great Depression was still in full effect! An anonymous questionnaire survey of the '81 '28ers in attendance showed an average annual income of \$3,800, an average net worth of \$14,000, home valuation of under \$8,000, and life insurance coverage of \$16,800. All of these figures compared well with similar surveys of 10-year reunion groups at Harvard University and at Brown University.

We have some further input from **Frank Taylor** who tells of a visit last summer to the American Precision Museum in Windsor, Vt., with **Mary Nichols**. That museum is of special interest to Mary since it is the repository of historical material from the W.H. Nichols Co. in Waltham, Mass., where our classmate, **Arthur A. Nichols**, played a prominent role in developing and managing the company. The museum was the brainchild of one of Frank's former colleagues at the Smithsonian Institution. . . . The first recipient under provisions of the **James Donovan Memorial Scholarship Fund** (Department of Chemical Engineering, MIT) has been named, and Frannie has been so advised. . . . Gladys **Olken** is doing well at home following her recent major heart surgery. This is a reliable firsthand report direct from the patient herself by telephone. . . . **Judith (Mrs. Benjamin F.) Miller** stays loyally in touch with '28 via **Florence Smith**. Although Judith reports slow improvement from recent illnesses, she is still severely limited in travel capabilities. However, a few special trips to family members have been accomplished.

We were very pleased and honored to receive an invitation from **Allece (Mrs. Thomas E.) Garrard** to the formal opening of **Garrard Ardeneum** in McAlester, Okla., on April 1, 1990. The occasion, marking also the centennial of the University of Oklahoma, was celebrated with an impressive program of music, poetry, and distinguished speakers. The music appropriately dedicated to Tom. We had to send our regrets but do hope for a later report from Allece.

It is with deep regret that we report the following two class-related deaths: **Ralph H. Martz** died on November 4, 1989, in Downers Grove, Ill., while hospitalized. Ralph became a member of our class as a graduate student. He already had his BS degree in electrical engineering from Bucknell University. Following early experience at General Electric Co. in Lynn, Mass., and Erie, Pa., he joined the engineering staff of the Chicago Transit Authority and there made his lifetime career in various engineering and administrative capacities. His wife was gracious and thoughtful in notifying the Institute of his death. . . . **Velma (Mrs. Charles H.) Worthen** died of a heart attack December 2, 1989, only nine months after our loss of Charlie. Velma's death was something of a shock to us because we had been just recently in correspondence with her. We talked by telephone with her daughter, Sheryl, who explained that the heart problem had existed for some time. To the families of these, our deceased class associates, we extend our heartfelt sympathy.—**Walter J. Smith**, secretary, 37 Dix St., Winchester, MA 01890; **Ernest H. Knight**, assistant secretary, Box 98, Raymond, ME 04071

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Howard L. Rich of Chatham, Mass., and his wife, Barbara, are enjoying their golden years of retirement on beautiful Cape Cod. They have two

children and four grandchildren, and their hobbies include painting, golf, and birdwatching. They send their greetings and best wishes to all our classmates.

Jackson M. Emery, of Morristown, Pa., sends a note, "Early this year, after 12 years of cooking for myself, I decided to move into a retirement facility (not far from my home)—Senior Suites, where I have my own efficiency apartment. I eat three meals a day in the dining room, have weekly linen and maid service, and daily trash pick up. There are organized activities for those interested and a nurse on duty for those who may need her. I live about ten minutes from my former apartment, so I can keep up with my friends, doctors, and so on. Best wishes to all '29ers."

Chung Foy Yee, of Worcester, Mass., writes, "I am now living with my wife in Worcester. We are enjoying fairly good health. When the weather is good, we generally go to a nearby park and take a walk for a half hour or so, which is good for our health. Please give my best wishes to your wife and all our classmates."

Harold M. Weddle of San Diego, Calif., writes, "Esther and I were pleased to know that the surgery you had on your eye was successful. I was scheduled to have a cataract operation last March 12, but it had to be postponed to a later date. Whenever Esther and I talk about you and our 60th reunion, we feel a very good friendship towards you." Harold and Esther have two sons and six grandchildren, five of which are in college. Harold says walking is a good exercise, and he estimates that he walked about 350 miles in 1989 for pleasure.

I regret to announce the death of **Oliver K. Noji** of Menlo Park, Calif., on August 22, 1989. He was born in Japan, but was educated in the United States having received a bachelor in architecture in June 1928 and a master of science in 1929 from MIT. He retired from general services administration but maintained his interest in watercolors. He is survived by three daughters (Carol Ida of Menlo Park, Calif., Shirley Tsurumoto of Alameda, Calif., and Janet Lee of Arnold, Calif.) and six grandchildren. His beloved wife, Kiyo, passed away in 1987.

From his wife, Margery, we have received additional information on **Frederic Celler** of Maitland, Fla., whose death was reported in the last issue (May/June). "Although he had been in poor health for two or three years and had to use a wheelchair much of that time, we did not anticipate his passing on so soon. It was, of course, a great blow to me and all our family, but considering his last five or six weeks, I can only be thankful he did not linger on. He was not able to swallow, and it was almost impossible to understand him when he talked. His mind was clear most of the time, and he died peacefully in his sleep. The MIT Class of 1929 meant a lot to him, and I attended the 25th, 30th, and 40th reunions with him. I was as sorry as he was that we could not attend the 60th reunion last June."

"Fred was born in Lyon, France, of French parents. His father, who knew and admired the United States, sent him to be educated over here—in Boston at the preparatory school, Noble and Greenough, then MIT, (aeronautical engineering). While at MIT, he was one of the founders of the MIT Flying Club, and its first president. He obtained, in 1928, a pilot's license from the state of Massachusetts prior to the creation of federal licenses."

After college, he was employed by a Franco-American company developing a blind landing system. When company funds ran out during the Depression (1934), shortly after the repeal of prohibition, he was employed by the S.S. Pierce Co. of Boston as a wine consultant because of the knowledge of wine he had acquired in France.

"After the debacle in western Europe in 1940, and having acquired American citizenship in the 1930s, he volunteered and was commissioned in the United States Naval Aviation. Called to duty early in 1941, during the war years, he was sta-

tioned in various Pacific locations where major Aviation overhaul bases were established. He was engineering officer, executive officer, and later liaison officer between the Navy Department in Washington and the Pacific Command in Pearl Harbor and various advance locations. A commander, he remained on active duty until late 1946. On the recommendation of his bank in Boston and because of his organizational capabilities, he entered a series of companies as manager, vice-president, or president to establish, reorganize, or develop. He spent several years in each, which took him to New England, Puerto Rico, Quebec City, New York City, and upper New York state.

"In 1960, he was sent to France by an electronics company to be president of its small subsidiary in the Paris suburbs. He remained in that position until his retirement in 1974, directing its expansion to an entity of nearly 1,000 engineering and marketing personnel. He was decorated by the French government for pioneering the employment of the handicapped in industry. During his years in France, he was active in Franco-American affairs. He was director, then president of the American Chamber of Commerce in France for several years. For many years, he was president of the MIT Club of France; co-chairman of the American Bicentennial committee; Commander of the European chapter of the Military Order of Foreign Wars, and other such activities.

"After four years of retirement in France, because of his wife's health, they selected the Winter Park area of Florida for their permanent home but returned to France for many summers. In Florida, he was a member of the University Club and Racquet Club of Winter Park and participated in the Foreign Visitors Reception and Foreign Trade Group of the Orlando Chamber of Commerce."—**Karnig S. Dinjian**, secretary, P.O. Box 83, Arlington, MA 02174

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Every five years we have what might be called a "lame duck" version of the class notes and this is it. My current term as class secretary expires in June, and these notes, written in March, will not be published until July. Since I have agreed to continue as secretary, perhaps I shall have embarked on another five-year term by the time the July issue reaches you. I plan to report the 60th reunion in the October issue.

Win Hartford sent a copy of his "Christmas 1989" letter to Yicka Herbert, who has passed it on to me. As previously reported, Win is, among other things, a professor emeritus of Belmont Abbey College in Charlotte, N.C., and an expert in the field of environmental science. Noteworthy 1989 events in the Hartford family include Win's teaching an adult class at Belmont Abbey entitled "A Scientist Looks at the Future," reported to have been a "great success," and a 50th-wedding-anniversary trip to Hawaii. Later in the year Win had left-eye cataract surgery that was also successful ("Now 20/20 and 20/30 and don't need glasses for anything!"). Still later in the year Win traveled to India for the International Executive Service Corps and reports that "The folks are wonderful to work with and the project was most successful." Win says hurricane Hugo treated his home lightly with only one tree down, but that in the Charlotte area generally "1 million significant trees were destroyed." In reviewing my records on Win, I happened to note that he was born June 1, 1910, and thus if my records are correct, he is the youngest survivor of the class of '30.

We have received notices concerning the deaths of two more classmates: **William (Max) Wheildon** on December 9 and **Charles Prichard** on January 7. . . . Max worked as a research engineer at Norton Co. in Worcester, Mass. While at Norton, he developed the Rokide ceramic coating used for internally coating the nozzles of rocket motors for spacecraft, as well as many industrial applica-

tions. He received 15 patents and wrote several technical articles in this field. After retiring from Norton in 1973, he remained active in three "s" fields—shooting, sailing, and skiing. Thus he had a life membership and certified instructor ratings in the National Rifle Association in five areas to support his work with the junior activities program of the Southboro, Mass., Rod and Gun Club. His sailing activities included acting as navigator on the 142-foot schooner *Sherman Ewicker*, a "dory" schooner that sailed out of Lunenburg, Nova Scotia, to the Grand Banks for cod fishing. He was also a professional ski instructor at the American Ski School, and had "a little ski lodge" in New Hampshire's White Mountains. Max's wife Edla died in 1987. He is survived by two sons and a daughter. . . . Charley Prichard came to MIT after two years at Dartmouth. He spent much of his career managing gas and electric companies. He was president of the Nantucket Electric Co., the Manchester, Mass., Electric Co., and Gas Service, Inc., that serves Nashua, Keene, and Laconia, N.H. At one time he was president of the Chamber of Commerce in Nashua. In recent years he had become legally blind and lived alone in a retirement-community apartment in Nashua. He is survived by his daughter Linda of Amesbury, Mass.—**Gordon K. Lister**, secretary, 294-B Heritage Village, Southbury, CT 06488

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Had a note from **John Swanton** that he had visited Florida the first of the year. Not all of it was pleasant, as he said he wound up in the hospital in Lake City, Fla., for four days with pneumonia plus asthma. Before that, he and Louise visited **Al Sims** and his wife, Lillian, in Englewood, Fla. They had planned to visit Laura and **John Olsen** in Nokomis, Fla., but John got sick and had to start home, stopping at his daughter Barbara's in Roswell, Ga., for a short stay on the way.

John Shute sends the following note about a classmate with whom he became well acquainted our freshman year when he worked for *The Tech*: "Some members of our class may remember **Harry Goetz**. Even when he entered MIT, his primary interest was in painting. He transferred to Harvard at the end of his freshman year, where he completed his sophomore year and then moved to France to further his studies. Except for a brief visit in 1931, he never returned to the U.S. He was active in the resistance and, after the war, acquired French citizenship."

"As 'Henri' Goetz, he became a distinguished abstract painter whose works are in major museums and private collections around the world. Goetz invented a new method of engraving using silicon carbide powders. He was a friend and respected colleague of painters such as Hartung, Picasso, and Miro, and of the poets, Paul Eluard and Andre Breton. In Villefranche-Sur-Mer, where he spent his summers, there is a museum devoted to his work and that of his late wife, the painter Christine Boumeester. Goetz was an officer of l'Ordre des Arts et des Lettres."

One of the busiest chaps in our class was **Richard "Dick" Kingman Baltzer**, whom all of us hoped to see at next year's reunion. But a note from his stepson, Allen B. Isham, '56, informs us of the sad news that he died on December 3, 1989, in Tallahassee, Fla. In the fifties, Dick was vice-president of the Avon Sole Co. and became president in 1963. During World War II, he served on the oil rationing board, the Pembroke School Board, and later the Silver Lake Regional School Board. Then in 1970, he was elected town clerk of Pembroke, Mass., and served until he retired in 1984.

Shortly after Dick died, his wife, Madelon, contracted pneumonia and died on January 23, 1990. Three daughters and two sons survive them—Christine Parks of Boynton Beach, Fla.; Sally Hargon of Hollywood, Fla.; Susan Green of Tallahassee; Allen Isham of Newark, Ohio, and John

Isam of Santa Barbara, Calif.

A sad note from **Harold J. Davis** tells us his wife is totally incapacitated and has been in a nursing home for two years. He is keeping busy on the Chelmsford Historic District Commission, acting as church clerk and delivering senior lunches, "as well as trying to keep house." He took a day off in June to go to the Boston Pops with the Cardinal and Gray Society. Several of our class were there.

Harold asks about **Lyman Chandler, Jr.**, who was in the same VI-A group with him. Lyman had lived and worked in Mexico for many years, but Harold was advised that he had contracted a serious nerve disease about ten years ago and had gone back to his original home in East Aurora, N.Y. The directory lists him without any address. Can anyone advise about him?

Ernest B. Whitworth of Charleston, Ill., died December 13, 1989. He had been chief chemist with the Arkansas Co. in Newark, N.J. He is survived by his son Ernest B. Whitworth, Jr., of Charleston and a daughter, Sarah J. Wentworth of New York. . . . **John R. "Bob" Gardner** died January 8, 1990, after he was stricken at his home in Burnt Hills, N.Y. He retired from the General Electric Co. in 1971, where he had been a senior project engineer selecting sites for new plants. He was a photography bug, photographing each America's Cup yacht race since 1934 and had won awards with his photography, including a Kodak award and a weekly gazette photo contest award in 1986. He served as a major in the Army in World War II. He is survived by a son, Ralph P. Gardner, of Troy, N.Y.; a stepson, Forrest S. Young, of Center Harbor, N.H.; a brother, Floyd Gardner, of Concord, N.H.; two grandchildren, and a great grandchild.

John H. Mennick of Laconia, N.H., died December 20, 1989. He served as a commander in the Navy in World War II and was an engineer for Shell Oil Co. for 27 years. Survivors include his wife, Frances, a son, Jeoffrey, of Sarasota, Fla., and two brothers.

Ruth Irene Parsons Fuller (a graduate of Bates College), who was a graduate student 1930-31, Course VII, died December 15, 1989, at a Kittery, Maine, nursing home. She put her new knowledge to work as a public health teacher in Malden and was afterwards executive director of the Maine Tuberculosis and Health Association during the fifties and sixties and returned to York, Maine, in 1978. She is survived by her husband, John, a son, David, of Norway, Maine, and two daughters—Mary Jean Farrington of Cambridge, Mass., and Sarah Lessard of East Setauket, N.Y.

Another sad note from **Leo L. Carter**, 34, advises that **Col. Francis Arthur "Art" Lutz** of Arlington, Va., died of an aneurysm last March 11 in Brunswick, Ga. He had been vacationing at Jekyll Island. Many of us remember him on the field day football and swimming teams and the musical and instrumental clubs. He served with the Army Ordnance Corps in World War II, went back to the family lumber business in New York, and was later called back in to service for the Korean War. Afterwards, he worked for the Army Ordnance Corps as a civilian, retiring from the Reserve in 1961 and Civil Service in 1972. He is survived by his wife, Alice, two children, and three grandchildren.

This has been the saddest collection of notes I have written, and our commiserations are given to the families of these classmates.

On a more positive note, see "New Germeshausen Professor appointed," this issue p. MIT 37. . . . In reviewing our class books, I notice that **Addis Kocher** and **Bob Gardner**, like me, started with the class of '30 but wound up in '31. I think I was the first dropout of '30. Five weeks into the first year (I played in two games with the '30 football team), my appendix acted up, and my Uncle George (who was one of the old fashioned, very careful doctors) would not let me go back after the operation for a solid month. My calculus instructor Professor Bailey, and Dean Tal-

bot suggested that I continue the following year. So I left my high school buddies, Jack Vennard and Bill Lockalin (who graduated in '30), and went home to work for the Granite State Fire Insurance Co. until the next September. Addis noted he had dropped out once to work, and Bob Gardner switched from chemical engineering to civil. Guess I was the only one who ever played on the freshman football team of two classes. I was in the hospital when class of '30 played class of '29, but it was interesting the next year to be back playing against my former teammates on a very wet field.—**Wyman P. Boynton**, secretary, 608 Middle St., Portsmouth, NH 03801

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Frances Gowen writes that he and his wife Trudie had a wonderful month-long vacation with their Italian family in Arezzo, Italy. They took part in the grape harvest in the family vineyards. They also spent time in Florence. This summer they expect some of the family to visit them in Massachusetts.

We received a telephone call from **Jim Robinson**, San Francisco. He is deeply concerned about who will be the next president of MIT and hopes that someone from engineering or science will get the post. He thinks the '90s will be a challenge to the technical community. Jim would like to have a class reunion in Hawaii.

We heard indirectly from **Manley St. Dennis**, Honolulu. He and his wife, Savina, are well and are hoping to be at our 60th reunion in 1992. . . . **Edmund McLaughlin** and his wife, Polly, have been on the move this year: two weeks in New Zealand in the spring of '89; two weeks in Greece in early summer; and three weeks in the late fall in Fiji, Tanga, and western Samoa. And last winter, they left Maine to go up the Amazon River.

George W. Muller is still very active. Gardening is his big hobby. He has a forest full of rhododendrons and plants from China and Himalaya. He recently traveled to Singapore, Vermont, and Hawaii. He enjoys and gives a lot of time to his grandchildren. Besides being active in several plant societies of the Pacific Northwest, he also is the director of the 50-year history of the sugar industrial society. In 1991, they will publish *Sugar Industry Technologists*.

Kenneth W. Smith is very busy taking care of his wife, Betty, who has Alzheimer's disease (memory loss). He practically absorbs his whole life now. He occasionally is able to get out on the golf course, which is good therapy for the body and soul. . . . **Carlos Burnett**, of Lancaster, Pa., is enjoying his retirement. When he is not traveling, he enjoys doing volunteer work.

We have received word that **Addison S. Ellis** died on November 14, 1989, at the Cathedral Village Retirement Home in Philadelphia. He joined Smith, Kline, and French in 1936, where he served in many capacities and was vice-president for four years. He retired in 1969. He was active in many civic, religious, and charitable organizations. After serving on the board of managers at Children's Hospital for 42 years, he was honored this past June as one of the most respected and wisest of men. He is survived by his wife Marion, three daughters, and four grandchildren.

I was pleased to see that our class was well represented among the substantial contributors to the Alumni/ae Fund, with 36 listed in Sustaining Fellows, President's Fund, and Great Dome Associates. (See *Technology Review*, May/June, pp. MIT 39-49.)—**Melvin Castleman**, secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

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Fred Feustel died last January 6, leaving a son, Edward A., 26 Dopping Brook Rd., Sherborn, MA 01770. . . . **Gordon C. Thompson** of Miami died December 31, 1986. . . . **Lloyd Matson** died

November 12, 1987. Apparently, his entire career was with the Immigration Service. Mrs. Matson resides in Burlington, Vt. . . . **Bob Forbes**, Course 15, died March 11, 1990. His career included Corps of Engineers in Texas and Rhode Island and TVA at Knoxville. He was a lifelong friend of **Warren Daniels** and a strong supporter of Glee Club and other choral groups. Mrs. Forbes lives in Louisville, Tenn.

Clint Backus died January 22, 1990, and thanks to **Bill Huston**, we have the following. His degree was in naval architecture. He was a purser on Matson Line between San Francisco and Hawaii and was a lieutenant commander in the Bay Area during World War II. Following the war, he started a career in real estate development and management in Los Angeles and was married in 1948. With his wife, he owned and managed a ranch in California, and said the only opportunity to exercise his architectural skills was in the designing of his home cantilevered over a deep gorge in the Belair section, with a striking view of the Los Angeles Basin. Mrs. Audrey Backus lives in Los Angeles.

Newton W. Buerger, Course 12, PhD, died. He served in the Navy and on the faculty of MIT, Queen's University in Toronto, and the Naval Postgraduate School, where he was professor of metallurgy for 27 years. Thereafter, he was chief metallurgist at Viking Metallurgical. He was instrumental in the development of titanium in the aerospace program. He appears in *American Men of Science*, *Who's Who in the West*, and *Who's Who in American Education*. Mrs. Buerger resides in Carmel, Calif.

Your humble secretary realizes that this report is overburdened with unhappy news of classmates no longer with us. By coincidence, replies to **Dick Fossett's** letter are rather numerous from such as **Berj Tashjian**, **Charlie Britton**, **Dick Molloy**, **Ed Atkinson**, **Art Hungerford**, **Ferd Johnson**, and perhaps others. Forsooth, we can't hog all the space in this publication, so we will deal with those in the next issue. Be advised, however, that we are sending to each widow a letter worked out by Dick, the undersigned, and others expressing our sympathy and inviting each widow to become an honorary member of the class. Upon acceptance, they will receive communications of interest and will be invited to class functions, such as reunions. . . . Call or write your secretary.—**William B. Klee**, secretary, Box 7725, Hilton Head Island, SC 29938, (803) 785-7746

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Please send news for this column to: **Robert M. Franklin**, secretary, P.O. Box 1147, Brewster, MA 02631; **George G. Bull**, assistant secretary, 4601 N. Park Ave., Chevy Chase, MD 20815

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By the time you receive this, our 55th will be history. Early returns show this will be a good one, and I am looking forward to seeing you there at MIT or Wianno.

The Lynn Screw Co. owned by **Ida and Macklen Kleiman** was for the fifth time in 15 years awarded Raytheon's Partners in Quality award for on-time shipments and quality for 1989. Lynn Screw is one of just 20 firms so honored by Raytheon out of its 6,000 suppliers. The company was acquired by the Kleimans in 1954, and it now has 20 employees and supplies aerospace hardware, electronic terminals and components, fittings for marine and aircraft vehicles, and automatic screw machined parts.

Over on the West Coast, **Sidney Grazi** hit the front pages of his local *La Costa North City Blade-Citizen* with a story detailing Sid's life as a tenor saxophonist, starting with dance bands when he was at MIT. Ramona and her Men of Music and the Lonnie MacIntire Band were the early ones with which he played at hotels across the coun-

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Charles E. Pfund
Philip G. Koenig

try. He ended up with the Lonnie MacIntire Band, playing for a year in the Hawaiian Room of the Lexington Hotel in New York City. Sid joined the Army in 1940, was in testing and development at Aberdeen, and married Ann in 1945. In 1950, they moved back to Denver, Ann's hometown. Sid's construction company built some of the major institutional buildings at the University of Colorado at Boulder plus a number of commercial buildings in Denver, including the state office building. He retired in 1979 and moved to La Costa in San Diego County. Now we have hopes of getting together some day for golf.

Please keep your line of communications open to me. My telephone is (619) 432-6446, and I have an answering machine that will give you three minutes to tell me how you are and what you're doing.—Allan Q. Mowatt, secretary, 715 N. Broadway, Apt. 257, Escondido, CA 92025

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After flying home from Seattle last January, I reached **Ralph Van Sant** in Sequim, Wash., by telephone. He joined our Course XV in 1935 as a graduate student, got an MS, and made his career with Gulf Oil. As managing director for technical services and development in Europe, Africa, and the Middle East, he was based 13 years in Holland, from which his ancestors had come to New Amsterdam in 1658. In 1975 some 300 relations had a family reunion in Holland. Ralph is a Knight of the Royal Order of Oranje-Nassau, bestowed by Queen Juliana. Ralph's friendship at Tech with **Adrian von Maltitz** (also Course XV) has continued over the years with a visit to Johannesburg and Adrian's coming to the U.S.A. twice.

On my way back from Portland to Seattle, had there been enough time for a long detour to visit **John Rowell** in Oysterville (Course IX-B), I would still have missed him. When I telephoned from Santa Fe in February, I learned that he had flown earlier in January to Brazil to visit his son and family. Unfortunately, I won't have another opportunity. John had had chronic asthma, and used an aspirator occasionally, but was in good shape when he left. Nevertheless, he died in Brazil of respiratory failure on January 23. My call reached a friend watching the house, who also told of his retiring from Anaconda Brass as director of engineering in Waterbury, Conn., and moving back to his hometown area in Washington. There he supported Sea Resources, the oldest fish hatchery in the state, with gifts, helping to educate students, and serving as corresponding secretary. John's wife, Eleanor, died in 1987. Cheers for their lives!

A response to the Alumni Office from **Mal Graves** (Course XV) in Lynchburg, Va., reads: "Still working at the Lynchburg Peace Education Center, but also on adjunct faculty of Averett College teaching in the MBA program, Adult Curriculum for Excellence." . . . **Bob Boden** (Course VIII) in Sedona, Ariz.: "Lived here since January 1978. Still keep in touch with **Bill Mullen**, **Mal Holcombe**, and **Randal Robertson**. Although currently recovering from retinal surgery, I can still accurately measure out an ounce of Kentucky stomach medicine. Suggest to **Frank Phillips** that he stop by in Sedona on one of his jaunts." Bob, you have been spotted on my AAA maps of Arizona since last year, and I hope to see you and other Arizonians this summer, touring in our camper.

Also from the Alumni Office, a response from **Bob Gillette**: "Our son and daughter organized a three-day celebration of the 50th anniversary of my wife, Jan, and myself at our summer cottage on Cape Cod. Sailing race, dinner party, four-boat picnic, and a day on a 12-meter at Newport. Also went on a 22-day cruise aboard our 42-foot sloop from Maine to Newfoundland. Crew were son, Ned, and three other younger men. A spectacular but forbidding coast and very sparsely in-

habited. Fog going and coming but luckily clear in N.E." . . . **Henry Lippitt** supplemented this note from MIT's first commodore of the Nautical Society, forwarding pictures of the sloop in full sail, with coves, sharp cliffs right out of the water, and weatherful skies in the background. Henry received these from Bob and Jan with their holiday greetings, with more news which I'll save for another issue.

Also from Henry, the holiday message from **Claxton Monro** and **Vicki**, who in 1989 continued their wide-ranging travels—Arizona, Kentucky, Colorado, New Mexico, Florida—by one or both with family and friends. All their children, except one in Australia, and many friends celebrated Clax's three-quarter century mark at the Petroleum Club in Houston.

A letter to President **Alice Kimball** from **Harry Donaldson**, Course V, tells of his coming to the 55th reunion in 1991 and wanting a blazer, which is being arranged. Harry and wife, Mary Frances, retired to her Raleigh, N.C., origins two years ago, after his career in public health and safety, pollution, waste disposal, etc. He had prepared for this with graduate work in industrial hygiene at Harvard after service in the Chemical Corps in World War II. But, as he put it, "Many problems in the public health area require a good chemical background," such as we got at the Institute.

A toast to the life of **Thomas Blakeman**, first to graduate with a bachelor's in city planning. A note from his daughter, **Beatrice Karstad**, tells of his death last January 31 at the age of 80 in Cataumet, Mass. Tom was a leader in regional development planning and, in the 1940s in New Jersey, laid the foundation for one of the first statewide development plans in the nation. Later, he pioneered the use of active technical committees of community leaders to plan and implement the Detroit Metropolitan Plan. Returning to New Jersey in 1957, he was advisor to the state, Hunterdon County, Lancaster County, Pa., and others, and lectured at New York University Graduate School of Public Administration. Tom's wife, **Virginia (Davidson)**, was also MIT Course IV, class of 1934, and both attended our 50th reunion. She stands ninth from left, back row, in the wives' picture, wearing her own cardinal red and silver grey. The family mentioned the Institute and the Cancer Society for memorial contributions. Virginia's address is Box 264, Cataumet.

Phoebe and I will be in Portugal when the deadline for this issue comes around and, on our return, will move to our new home (see address below). So these notes will go to **Pat Patterson** for his additions and submission to the *Review* in time. Thank you, Pat.

While **Frank** is away, I have the chance to say "Thanks, Frank," for your very strong devotion to the job of class secretary and for giving us '36ers such colorful and informative class notes. Let's all clap our hands for Frank.

Our class is honored in having class president, **Alice Kimball**, selected for the full page MIT Life Income Funds advertisement in the April 1990 *Review*.—**Frank L. Phillips**, secretary, 1105 Calle Catalina, Santa Fe, NM 87501, (505) 988-2745; **James F. Patterson**, assistant secretary, 170 Broadway, Pleasantville, NY 10570, (914) 769-4171

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Robert C. Glancy, Jr., 41 Grandview Ave., White Plains, NY 10605, writes, "We became great-grandparents in February. Our daughter Sharon's son and wife had a fine boy now starting to walk. Our daughter Carol, full colonel in the Air Force, announced her engagement to Col. David Nuss, USAF. Spent summer at Lake Waukegan, N.H., as usual. Just had a cataract operation, but a maculacyst continues to make reading nearly impossible." . . . **Edwin L. Hobson**, 72 Jeness Ave., Rye, NH 03870, writes, "See June and **Win Comley** for lunch often. Also **Roger Wingate** as well as **Joe Keithley** and **Agnes and Art Zimmerman** in Cleveland, Ohio. Spent a day fishing

with **Al Busch**. Keep busy with travel and my little firm, **Abanatti Corp.**, in Chagrin Falls, Ohio."

David S. McLellan, 77 Chestnut St., Weston, Mass., retired as Product Manager in 1975 from Reynolds Metals Co. His hobbies are outdoor housework, carpentry, amateur radio and piano. He writes, "Lived in Richmond, Va., 15 years, and in Phoenix, Chicago, Milwaukee, and Longview, Wash. Covered most of the U.S. Can't find any place better than New England. Have three sons (two musicians and one animator) and four grandchildren. Had a heart attack (no operation) and a back operation."

Joe Smedile (3579 Admirals Way, Delray Beach, FL 33483), in touch with **Bob Thorson**, writes, "Tis the season again; our tenth Christmas in this location. Where has all the time gone? This has been quite a year for us! Martha had two new strokes; one in April and the other in July. Both times she was hospitalized, three weeks and two weeks respectively. She continued physical therapy at the hospital on an outpatient basis until early October. She has made great recovery but is not up to the capabilities she had before. She is working on herself to improve with the passage of time. In between, we took a cruise to China! We had to sign up for it in the fall of 1988. After Martha's April stroke I was all for canceling out. But Martha would not give up her chance to visit mysterious China—the Forbidden City, the Great Wall, etc. Her doctors apparently felt the psychological benefits would outweigh any possible adverse physical impacts. So we went—by air to and from Hong Kong and the rest aboard the Norwegian Viking Line *Sea*. On board there was only one quarter of the rated capacity of passengers; many had canceled due to the fluid situation in China. Thus, we were spoiled by the personal attention of the ship's company. En route to China we first stopped at Keelung, near Taipei, Taiwan; next stop was Kagoshima, Japan. One June 3 and 4 we were in Shanghai on ground tours. When we returned to the ship, the captain explained what had happened that day in Beijing and that the rest of the trip was canceled. We were then returned to Hong Kong. When we got home, I found out that I had been elected president of the MIT Alumni Club of Palm Beach County.

"We had one close call with a hurricane this past year. After getting together our evacuation gear and were about to 'batten down the hatches,' on our house, the storm bypassed us and hit South Carolina. Our good luck was the misfortune of the South Carolinians. Gary and Pam are still with the corporate office of TWA in Kansas City. Pam received a grand promotion during the summer and Gary is scheduled for an upward move in the near future."

I regret to report two deaths. **Joseph A. Guerin** (8 Park Dr., Manchester, N.H.) died June 21, 1989, and **Chester F. Chollis** (10 Oliver Ave., Pennsville, NJ 08070) died January 17, 1990.—**Lester M. Klashman**, secretary, Brookhaven at Lexington, 307A 1010 Waltham St., Lexington, MA 02173

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The **Bruneaus** and the **Severances** were guests of the **Dave Wadleighs** the evening before the February 20 meeting of the MIT Club of Cape Cod. Of about 85 at the club meeting, our class had the largest representation: **Sandy** and **Lou Bruneau**, Virginia and **Dick Henderson**, Roberta and **Horace Homer**, John and **Anne Mowat**, Nancy and **Dave Wadleigh**, and Phyl and **Don Severance**.

The next day the Bruneaus were off to Florida where Lou had been invited to join a member-guest golf tournament at John's Island, just north of Vero Beach. Sandy has not yet been able to resume her golf since her fall months ago. In mid May, they plan to fly to the U.K. in time for the Chelsea Flower Show, staying until June 28, and thus missing our mini-reunion in June. Between

the Florida and European trips, Lou will still work as a member of the Chatham (Mass.) Board of Assessors.

Horace Homer is past president of the North Falmouth Village Association and the Precinct-5 Association and (currently) on the Falmouth (Mass.) Finance Committee and Capital Program Committee. Before this gets into print, he will also have taken on the duties in May as president of the MIT Club of Cape Cod. (Incidentally, Dave is past president of the MIT Club of Cape Cod, and both **Dick Henderson**, as well as **Horace**, are (at this writing) vice-presidents.

In our 50th reunion book, **Anne Mowat** listed music and gardening as her hobbies. She still plays the clarinet with the Barnstable Band. She modestly mentions spending a good deal of time in her garden, but I learned that some of her spectacular foxglove display was taller than she and that she gave over a pound of the resultant seeds to the Thornton Burgess Society in Sandwich.

Some months ago **Don MacDonald** announced the formation of Senior International Resources, Inc. in cooperation with David Steinberg, a Dartmouth graduate. This is a not-for-profit consulting enterprise to facilitate in our country the understanding of Asia. Among projects carried out by the two principals are an analytical survey of U.S.-Korean relations for the State Department, a study for the Department of the Army based on case studies of seven countries, and evaluation of the effectiveness of government and international bank aid projects in Asian developing countries—to name only three of several. Don's dissertation for his George Washington University PhD was on Korean political development. He has devoted over 20 years to life in and working on the policies and politics of Korea and other Asian countries. Among other assignments, he served in the U.S. Department of State, with postings to Korea, Switzerland (as executive officer of the U.S. disarmament delegation), Turkey, and Washington. He has been officer in charge of Korean affairs, and later director of the Office of Intelligence Coordination. He also served as international relations officer for U.S. Forces, Korea, and principal staff of Operations Research, Inc. Among several awards, he is holder of the John Jacob Rogers Medal for distinguished service in the Department of State, and he has served as president of the Mid-Atlantic Region of the Association of Asian Studies. He has published numerous articles on Korea, and soon to be published is the second edition of his book (which I've read), *The Koreans: Contemporary Politics and Society*.

Had a note from **Peer Cody** enroute from babysitting grandchildren in Virginia to a week's visit at Hilton Head. Promised more notes upon his return home (Barrington, Ill.) in April.

Ros and **Bill Brod** have bought a villa in Boynton Beach, Fla., where they expect to spend their retirement years, although the retirement date has not been announced yet.

The **Ed Trues** also found more opportunities for golf and the like in Florida, where they rented, than are available in Searsport, Maine, which is still their home. Unfortunately for us, their children's arrangements for their 50th wedding anniversary will prevent their attending this June's mini-reunion.

Barney Oldfield has been conscientious about keeping us up to date in our three class reunion books. When last we heard, he and Norma were enjoying life on Cape Cod and spending more and more time in Florida to escape the severity of New England winters. The International Health Evaluation Association, of which Barney was a founder, rotates its bi-annual membership meetings worldwide. In May 1988, he and Norma attended the meeting and symposium in Kona, Hawaii. While he presided as outgoing President of IHEA, Norma explored the island. They spent an additional week there, and you can anticipate the result. By August, their Brewster home was sold, and after two mammoth yard sales, the

movers took over the shipping of 5,000 pounds of "personal effects" and they took off cross-country in their car to embark from San Francisco to their newly purchased condo at 75-5865 Walua Rd., B510, Kailua-Kona, HI 96740. They both continue working, but in a less frantic environment in their transition to the softer, more laid back way of life on the Island. One reason for seeking this new (for him) lifestyle is his desire to write. In fact, his current ambition is to write a series of novels based around the evolution of high tech, starting just before World War II and continuing to the present. He has most skillfully summarized the myriad of positions and major responsibilities that made up his professional life. Unfortunately, space does not permit me to record it in full here, and because of the extraordinarily long deadline on class notes, I must submit July notes tomorrow. So, look for my gleanings of highlights from Barney's professional career in the next issue.

In closing, our president, **Horace Homer**, suggests I remind you that the off-campus part of our 55th reunion (only three years away) will be at Harborview Inn on the island of Martha's Vineyard—not Nantucket, as reported in these notes in **Ed Hadley's** poem. This resort has become an MIT favorite. Quite an island: 23 miles long, six-and-one-half miles wide, just off the coast. In the 1800s as many as 200 vessels could be seen riding anchor in the harbor of Vineyard Haven. It even had a train and trolley cars. In those days, it produced more whaling captains per male population than any locality in the U.S. In fact the builder of *Old Ironsides* was from there. So, besides now being a delightful spot for a leisurely reunion, it will provide you history buffs ample opportunity to become acquainted with its remarkable past.

That's it for now. Keep writing.—**Don Severance**, secretary, 39 Hampshire Rd., Wellesley Hills, MA 02181; **Ed Hadley**, assistant secretary, 50 Spofford Rd., Boxford, MA 01921

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MIT's Commission on Productivity completed its study and published its findings in a book, *Made in America—Regaining the Competitive Edge*. To encourage nationwide debate and discussion on this topic, 16 MIT faculty members will serve on the panel, and seminars will be held in eight major U.S. cities. The first seminar was well attended, February 22 in Seattle. **Jim Barton** and **Mary** returned from Hawaii to attend. **John Alexander** and **Nancy** treated their two sons and son-in-law, and I joined them for the meeting. We were stimulated and impressed and recommend with enthusiasm that classmates attend the seminar when it is presented in their neighborhoods.

George Beesley and **Eleanor** traveled our planet after reunion. Their itinerary started with a fishing vacation on Lake Winnepesaukee and continued with visits to Australia, New Zealand, Hawaii, and Fiji. Back in the USA, they attended the wedding of their daughter in Atlanta and visited **Dodie Casselman** on Sanibel Island. They report **Dodie** recovered nicely from a heart attack and hip replacement during 1989. They relay news that **Ernie Kaswell** and **Yolande** decided to move to Maryland. **George** serves on the Technology Day Committee for 1990-2 and looks forward to seeing many 39ers during June in Cambridge.

Harold Muckley maintains his office in Houston. He enjoys fly fishing and periodic visits to Boston, where he serves as life member of the MIT Corporation.

Daniel F. Rex received the Achievement Award, highest honor awarded by Wichita State University Alumni Association. Dr. Rex's degrees were earned at Wichita State University Alumni Association. Dr. Rex's degrees were earned at Wichita State University, MIT, University of Tennessee, the U.S. Naval Postgraduate School, and the University of Stockholm. He served 22 years before retiring as captain from the U.S. Navy. Mt.

Rex, located in the Ellsworth Highlands of Antarctica, was named in his honor as a result of U.S. Navy support of the Ronne Antarctic Expeditions of 1946-48.

John Alexander and Nancy expect **Smitty Curtis** and Muriel from Boston to share summer fun and motor cruising this summer on Puget Sound's U.S. and Canadian waters.

As your secretary survives celebration of his 74th birthday this 28th day of March 1990 and writes these notes he invites each cotton-topped classmate who is older to volunteer special news-bits and enclose photocopies of favorite birthday cards received recently, no matter how startling the art and messages.

Gus Hunnicke's voice came lively and strong over the phone as we reminisced about good times shared when he and Prilla hosted classmates from time to time after graduation in their Brooklyn Heights apartment. Gus says recent study of their family tree revealed Prilla has connections through three branches to pioneers who came to America on the *Mayflower*.

We are saddened by report of the death of **Richard L. Steiner** on December 13, 1989, in Baltimore. There were no details.—**Hal Seykota**, secretary 1701 Weatherswood Dr., NW, Gig Harbor, WA 98335

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When you read this, the great 50th reunion will be history. As it is being written (two months before the event), I cannot yet give any report or summary, but that will be included as soon as possible. As of now, everything looks great for a highly successful get-together!

Unfortunately, I have no positive news this month, but there are three obituaries to note. On December 16, 1989, **Alfred N. Ackerson** of North Syracuse, N.Y., passed away. There is no further information. . . . **Edwin G. Brush** of Pacific Grove, Calif., died June 12, 1989. He was an Army veteran of World War II and a metallurgical engineer for General Electric for 35 years before retiring in 1979. He was a member of the Elfun Society of General Electric.

Yardley Chittick, of the class of 1922, sent me a clipping from the *Granite State News* telling of the death of **Herbert A. Bing** in Tuftonboro, N.H., on March 21, 1990. Before moving to New Hampshire 12 years ago, Herbert lived in the Wayland and Wellesley area of Massachusetts. He worked closely with Dr. Edwin Land at the Polaroid Corp. on several of the designs. He also worked with Eastman Kodak in Rochester, N.Y. He was on the board of directors of Carroll County Health and Home Care Services, sang in the choir of Melvin Village Community Church, was on the diaconate of the church, and was a member of the building committee for Tuftonboro Free Library. . . . On behalf of the class of 1940, we extend deepest sympathies to the three families.

I look forward to many post-reunion letters and calls from class members. It is information from you that keeps this column going.—**Richard E. Gladstone**, secretary, 1208 Greendale Ave., Needham, MA 02192, (617) 449-2421

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Great letter from **David S. McNally**: "As far as my own background is concerned, there are a few things to my credit, but not many. When a sweet young thing with an acid tongue asked me what my claim to fame was, all that came to mind was that I was the first white man to sign a treaty with the Seminole Indian tribe, if not the only one. It turned out that that was not what she was interested in!

"Picking up where the 25th reunion book (edited by **Mitch Marcus**) leaves off, I went from Amphenol Connector Division to president and CEO of Coleman Cable & Wire Co., a small con-

glomerate in the electrical and electronic business. Grover M. Hermann, former chair of Martin Marietta and sponsor of the Hermann Building at MIT, was the principal stockholder and the one who invited me to take over the enterprise. After completing this assignment in the early 1970s, Anne and I retired and moved to Seminol, Fla. (West Coast, just south of Clearwater), where I continued with projects for connector companies (e.g., Pyle National) and some retail interests in Tampa having to do with music, one of my avocations.

"Then to California again, to assist our son-in-law in the management of some auto-rental franchises, including L.A. Airport, San Diego, John Wayne, Orange County, Anaheim, etc. (Thrifty Rent-A-Car). We left this semiretired condition to accept an exciting and challenging project here in McAllen, Tex. We moved here in 1979 to build and operate a plant for the assembly of a new military ration called the MRE (Meal, Ready-To-Eat). There was to be no food processing—only high-speed assembly on a mass-production basis. The difference was that the components were many packets of food, rather than electronic assemblies. The principal was the same, however, innovative for the industry. Two other companies would fail, and a third one failed later because of high quality control and substantial technical risk. Only one other company, besides ours, survived the production test phase."

This is the first installment of David's letter. Future installments of this column will continue this historic story.—**Joseph E. Dietzgen**, secretary, Box 790, Cotuit, MA 02635

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Stan Golembe, retired from Litton Industries (not new news—it was in 1986!), has been travelling to Australia, New Zealand, Fiji, Tahiti, St. Croix, Antigua, St. Martin, Florida, Los Angeles, and New York. He also takes several courses each term at the Harvard Institute for Learning. . . . **Bart Hakan** retired from Moken Chemical Co. of which he was owner and chairman, and started a new business, American Beverage Container Corp. He travelled in Russia last year and played in the senior tennis tournament at St. Moritz during the summer. Always modest, Bart did not report where he placed in the competition.

Jim Littwitz retired as general manager of Eastman's Kodak Park Division and is providing management consulting to non-profit agencies in the Rochester area. . . . **Chuck Magdsick** has recently retired from his "retirement" position, which was director of the Center for Business, Religion, and the Professions at the Pittsburgh Theological Seminary. He's back to consulting and to vacation travel.

Charlie Ruckstuhl is still "hamming it." His call sign is: W1JZD on everything from 160M to 2M (that is, 1.8 to 146 MHz). So you other hams, give him a call. He plays his three pianos (I assume, not all at the same time) and continues to add to his 4,000 record 78 rpm collection. . . . **Edward W. Smith** either Ed or Ned to some, is living on an island at the mouth of Narragansett Bay, off Newport, R.I. He's director of the Yachting Museum and is active in the local marine museum and in the library.

Dave Baltimore and his son, Charles, '77, operate a flight planning and weather briefing service for private pilots and are now in over 90 airports in the U.S. and in Canada. He also is on the board of the local hospital and in various JCC endeavors. . . . **Bob Benware** built his retirement house at Lake Memphremagog, Vt., and lives there year round. His travel is by motor home thus far to Colorado, California, Texas, Illinois, and in New England.

Don Berkey winters in Naples, Fla., and summers at Harwichport, still playing the trombone in two bands and playing the electric organ at home. He has seen **Gordon Brown** in Florida and **Charlie Hoffman** on Cape Cod.

One obit, and this from last November: **Bill Chepulis**, Course VI, died in North Andover. He was very active in local affairs including membership in the North Andover Conservation Commission and the town's historical society.

My thanks to all of you who answered the "Class of 1942 Open Book Exam." Your replies will appear in the column, several each month. At that rate, I have enough news to last several years!—**Ken Rosett**, secretary, 191 Albemarle Rd., White Plains, NY 10605

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We were shocked and saddened by the death of **Richard B. Adler** of Concord, Mass., in an automobile-pedestrian accident last February 6. Dick was an outstanding member of the MIT faculty in the Department of Electrical Engineering and Computer Science, and was prominent for his contributions to engineering education. His wife Dottie has for many years held a key position on the Alumni Association staff. Dick's life and his career at the Institute were praised by President Paul Gray and by a Ceremony of Remembrance in Kresge Auditorium. Our sympathies and condolences go out to Dottie and the other members of Dick's family.

Notes from **Jim Hoey** and **Jim Casserly** report the passing of **Frank Swenson** in Chippewa Falls, Wisc., January 28, after a long illness. Frank was a native of Akron, Ohio, where he attended public schools. From there he went on to Kemper Military School and MIT. After graduating in Course II, he served with the Army Anti-Aircraft Corps in Oregon. Post-war, Frank ran a drive-in restaurant while studying medicine at Case-Western Reserve. Following an MD in 1957, he completed residency in radiology and joined that department at Akron City Hospital, where he was department chair from 1971 to 1977. Retiring from that post, Frank moved to Chippewa Falls, serving in several hospitals and specialized medical facilities until his final retirement in 1986. Frank is survived by his wife Polly, five children and several other family members. to them we extend our condolences.

At this writing, **Virgilio Barco**, fully occupied with his responsibilities as president of Colombia, is nevertheless scheduled to be MIT's commencement speaker on June 4. He will complete his term of office August 7, which may allow him to attend the 50th reunion.

Here is the fourth and final communique from the October Classic in New Mexico. Monday morning was Independent Activity Period in Santa Fe, with the group splitting up for sightseeing at leisure. Susan and I took in breakfast at La Fonda, and went to the Cathedral, the Governor's Palace, and a number of pricy jewelry stores. After a group reunion for lunch at Bishop's Lodge, we again went our separate ways. The **Rorschachs** joined the **McDonoughs** for a visit to the Santa Fe Children's Museum, where Jim and Roz's son Gordon is a staff member. This museum cannot be described in a few words, except to say that it is a wonderland where children get right in and work the displays themselves. Late in the afternoon we began to straggle back to Albq. That evening, some rested in their suites while others gathered for supper at a nearby restaurant-club featuring a musical combo.

Tuesday we met again at the **Ottiger** home for a sumptuous brunch, one more of the memorable meals we enjoyed during this outing. As part of the festivities, and to show our deep appreciation, the visitors presented Harry and Sue a Steuben crystal bowl, etched with the legend "GSWCFMM 1989" and filled with M&Ms. Then it was good-bye time as some began leaving to return home. A few stayed over another day, but as a group effort, the Great South West California Florida Midtown Manhattan meeting became history, fondly remembered by all who were part of it.

The 50th reunion plans are progressing, with

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Mario Banus reports that they escaped hurricane Hugo in Seabrook, S.C., with minimal damage. After strenuous preparations to home and boat, they went inland to Aiken, S.C., to wait out the storm. Barb and he had a busy year, as well, traveling to Alaska and visiting friends in Washington State. Mario was appointed a full professor, part time at the University of South Carolina and teaching oceanography and lab at the Beaufort Campus. He is still very active in the Coast Guard Auxiliary. . . . **Lawrence Button** has retired to Sarasota, Fla., and is an enthusiastic member of the MIT Club of Southwest Florida. He is a new member of the Mechanical Board of Appeals, serves as an election poll worker, writes tax returns for the elderly, and volunteers in the Blood Bank. His greatest joy is unemployment.

Joseph Crowley passed away on January 6, 1990, in Wayland, Mass., after a long illness. Joe's passion while at the Institute was playing baseball in the quadrangle next to Walker Memorial in good weather and cards in the 5:15 Club at other times. He retired from Honeywell in 1987 after a long career in the electro-optics field, receiving patents and a special citation from the American Institute of Electrical Engineering for his work. Our sympathy goes to his wife, Marcie, daughter, and three sons. . . . **Arturo Morales** has returned to mining engineering, his first degree in engineering. Last year, he was elected president of the Mining Branch of the Mexican Academy of Engineering. He sends best wishes to all his classmates.

Paul Slepian has requested the Alumni/ae Association to change his class affiliation from the class of 1950 back to the class of 1944. Due to the war, Paul left MIT in 1943 and didn't return until 1949, the experience of so many of us. Paul received an SB in math in 1950 and a PhD in math from Brown University in 1956. Over the years, he has taught math at various universities and retired as a professor from Howard University. We hope many other 1944 class members who ended up graduating in other classes due to the disruption of World War II will reaffiliate with 1944 in time for our upcoming 50th reunion. Welcome back, Paul.—Co-secretaries: **Andrew Corry**, P.O. Box 310, W. Hyannisport, MA 02672; **Louis Demarkles**, 77 Circuit Ave., Hyannis, MA 02601

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Please send news for this column to: **Clinton H. Springer**, secretary, P.O. Box 288, New Castle, NH 03854

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Coming up to the eve of "deadline day," I was at a loss on what to offer this month. But out of the blue, **Mario Vinci**, one of my many ex-roomies, called in from Laguna Beach, where he was relocated to a new address. He was remarried last August, to Rose. He sounded chipper and busy with his retired pursuit of financial planning, which has been remunerative without being hectic. The alumni/ae office was kind enough to send me an up-to-date zip-coded directory that should facilitate my desire to stop in on old classmates during hoped-for tours around the country. Right away I found a likely prospect, **Roger Bart**, who has a new address at Beaufort, S.C. (just north of Hilton Head), our destination during our "grand tour" of the eastern seaboard in late April. Roger and wife, Elaine, '45, decided on Beaufort as an ideal winter home (hurricane Hugo notwithstanding, and they sail up to their

Martha's Vineyard home for the summer. Roger's another busy one, partly due to a computerized financial planning program he's working on. Maybe he and Mario (a fellow New Yorker) could work something out to save us poor retirees from poverty?

As I thumbed through the directory, I also came across another interesting, kind of heart-warming connection that verified, in a way, the old "birds of a feather" adage, to wit the discovery that two of our Course XVI coed classmates, **Betty (Bunte) Stevens** and **Pauline (Glazier) Teague** are now living in the same town, Ocean-side, Calif., just south of Camp Pendleton. If memory serves, they both started their careers at Boeing right out of school. Later, they migrated to assorted places in southern California and other roundabouts, finally becoming virtual neighbors.

Back on our upcoming tour, I had hoped to drop in on another old roomie, **Al Little**, living in Media, Pa., during our stay across the Delaware in May, but time constraints prevent it. Next time around, Al, I promise.

And you never know what you're going to run into in the amanuensis gig. Take **Art Verrier**, one of our older V-12ers who came to us "out of the fleet" after a short stint at Harvard and cranked out a Course II degree with the rest of us. Raised in Providence, R.I., he ended up back there (or thereabouts) "maintaining the growth curve" of a Rhode Island textile machinery manufacturer for the next 37 years. He took a three-year "sabbatical" before giving it another go, but by now he's probably gone into "contented retirement." He and his wife, Claire, now living in N. Kingston, on Narragansett Bay, raised four children, all of them pursuing commendable careers. And, oh yes, the reason they didn't make our 40th reunion was they were celebrating their own 40th wedding anniversary on that September 26. Which brings up the question of where and when and what we'll be doing for our 45th next year? Anything cooking, John?—**Jim Ray**, secretary, 2520 S. Ivanhoe Pl., Denver, CO 80222

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Bernard "Bay" Rabinowitz was recently appointed to the board of trustees of United Hospitals Medical Center in Newark, N.J. He is the creator and publisher of New Jersey's newest weekly magazine, *New Jersey Focus*. It is inserted into the Sunday editions of nine of the state's largest newspapers. Bay co-founded Atlantic Industry when he graduated from MIT and served as president and CEO of that company until 1987. In 1987, he pledged \$250,000 to MIT to support graduate students in MIT's Technology and Policy Program. This program combines strong technical and scientific foundations with skills in dealing with social concerns. Bay's commitment to public policy is obvious—he is chairman of the Commissioner's Cardiac Service Committee, serves on the Citizen's Commission for AIDs for New York and New Jersey, is on the advisory board of the Center for Technology at MIT, and is also on the St. Barnabas Burn Foundation Board.

Robert H. Kingston was one of the recent group of engineers elected to membership in the National Academy of Engineering. Academy membership honors those who have made "important contributions to engineering theory and practice," or those who have demonstrated "unusual accomplishment in new and developing fields of technology." Bob's appointment was for "pioneering quantum electronic device research and its application to modern microwave and optical radar systems." He is adjunct professor in the Electrical Engineering Department at MIT.

Paul Cook retired as chairman and CEO of Raychem on April 1; he will continue as chairman. . . . **John Breen** died in January; we just received notice. He was retired from Raytheon and is survived by his wife, Lucille. She notes that he was always "a great booster of MIT."

This month we had a long letter from **Abbott Fletcher**. (Ab was one of my housemates in the Student House.) He has been with the Bath Iron Works in Bath, Maine, for many years. Currently he's working on a prototype for a new destroyer, *Arleigh Burke*, "a significantly more effective and survivable ship than ever before." Ab and his wife are fortunate to have their son, Max, living only 100 yards down the road from them on Orr's Island and their daughter, Judy, and her husband living right across the road from Max! Ab is still working on getting their youngest daughter, Kristin, into the same area. (That's real family togetherness!) Ab still races his 38-foot sloop (something like 67 firsts in 190 races) as well as cruising the coast of Maine. This year, though, he plans to cruise the west coast of Greenland to Thule during the few ice-free weeks with Newbold Smith in his sloop, *Reindeer*. Ab tells us he is also involved in raising money to build the square-rigger *Discovery of America* and in trying to get Maine Audubon and the Maine Natural Resources Council to be more scientific in their approach to saving the environment.

Finally, a personal note. By the time this column appears, we will be living in Highlands Ranch, Colo. (address below). This has been a most eventful year for us so far. In January, my mother-in-law died, and we sold her house and our house in Elm Grove and bought a house in Highlands Ranch. In March, I was diagnosed with cancer, and surgery followed immediately. The good news, though, is that we caught it very early and got it all! I guess I'm now living proof of the value of annual medical check-ups!

Send news to Colorado!—**Robert E. McBride**, secretary, 1511 E. Northcrest Dr., Highlands Ranch, CO 80126

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Harold Ottobriani has agreed to be chairman of the mini-reunion with '47 and '49 planned for September 1991. Harold, Eleanor, and I plan to visit the Harborview on Martha's Vineyard to evaluate the facilities at the hotel. We would like to have a casual program after dinner on Saturday night at the hotel. Depending on availability, we are considering a band or a disc jockey. Mickey Ligor, '49, described an after-dinner program that '49 put together with classmate participation at their 40th reunion. The first mailing to all classmates won't be sent till early 1991, but publicity in these class notes will help announce our plans.

The class of 1947 invited us to join them at a brunch at Endicott House. Eleanor and **Harold Ottobriani**, Judy and **Graham Sterling**, Jean and **Milton Slade**, Virginia and **George Clifford**, and yours truly enjoyed the good company and the genteel atmosphere. Claude Brenner, Don and Kathy Van Greenby, Harl and Lois Aldrich, and Al Pastuhov were some of the class of '47. Mickey and Pam Ligor represented '49.

Carl Boll was expecting to be semi-retired, but it has not happened that way. After a life-long career, he sold Solvent Recovery Systems, a business he owned and operated in New Jersey. A part of the business that didn't get sold was Solvent Recovery Services of New England, which operates in Connecticut to mix and prepare fuels for cement plants. There are still problems with EPA, and Carl is commuting fairly frequently from his home in New Jersey to Connecticut.

Several years ago, Carl investigated the possibility of opening a hazardous waste plant in Haverhill, Mass. His not-so-favorite story is how candidates for governor of Massachusetts (from both major parties) came on the property and promised if they were elected the plant would never open. About his family: Carl says, "Everybody has their feet out from under the table." Three boys are married and his daughter is on her own.

When last we talked, Ann and **Ken Brock** were headed towards Baja, Calif., to see their "new



On an expedition cruise to the Antarctic early this year, L. Dennis Shapiro, '55 (left) and his wife, Susan, saw penguins, seals, albatross, whales, and many types of birds, creatures, and plant life.

They also met David Mobley, '89 (right) at Palmer Station, Anvers Island, who is with a research team to study the fragile environment in order to develop ways to enjoy the Antarctic without spoiling it.

land holdings." They won 5,000 square feet of land in a lottery, but there is no water or electricity available on the property. For \$14.50 the first year and \$29 a year for the following five years, they expect to become the proud owners. For a reasonable rental (available to classmates and their wives), they invite you to camp or place your recreational vehicle on the land.

Ann and Ken also plan to visit San Felipe (a four-hour drive from Tijuana), the Fort Lauderdale of the West Coast. Then they will fly to Cabo San Lucas at the tip of Baja, Calif., to see the whales of the West Coast, then on to a dude ranch in Tuscon, Ariz., and next a trip to the Grand Canyon. During my visit, I sat on a mule down the canyon rim to the Colorado River. Ken is hoping to find an aerial tramway to take him down the canyon. The Brocks' final stop is Caesar's Palace in Las Vegas (another first visit for them). Next September, they have made plans to tour England.

Joan and Al Seville celebrated their 25th wedding anniversary in April 1989 with a trip to Europe. Al is like a lot of engineers and does not have a good ear for languages (he admits it). He took a Berlitz course and then began in Florence, Italy, by mutilating their language. In Geneva, Switzerland, he made changes to German and French. After skiing at Zermatt, they went to France. Traveling through Andorra, they arrived to visit two families in Spain. In Catalone, he worked on changing Spanish. This year he has skied in Vermont when conditions permitted.

Barry Bloom was known among many of us in the dorms as the fellow to ask for help when organic chemistry was overwhelming. He always had the molecules classified in an understandable way. For a number of years, Barry has been head of central research for Pfizer Corp. This is an international operation and includes pharmaceutical (major part), animal health, and specialty chemicals. They have operations in the U.S., Europe, and Japan. Barry is based at the New London, Conn., facility. He is a director on the board of Pfizer and on their corporate projects committee (management committee). He is also a director on the board of Southern New England Telecom (SNET).

Bill Cummings and Art Fowle were boyhood friends. Our class reunions served to bring them up to date, and now they visit, more or less, annually. Bill and his wife, Barbara, live in Bonita

Springs, Fla., and Art and his wife, Mary, oscillate between Brewster and Woburn, Mass. Mary was Professor Phillips secretary when we were students. . . . Leonard Simon is chairman and CEO of Rochester Community Savings Bank in Rochester, N.Y. Recently, he was appointed a director of the Federal Home Loan Bank of New York.

Dave Brown is almost but-not-quite retired, and this has allowed time for a letter to his classmates after a long silence. He and his wife, Lou, sold their home in Wayland, Mass., where they had lived for 24 years, and moved to Kennebunkport, Maine, where they had spent weekends since 1975 and have been homeowners for five years. Dave still keeps a hand in the consulting business, but he is devoting more time to their four children and ten grandchildren. They have made some changes in their house to better accommodate visiting children and grandchildren. They recently made a business-and-pleasure trip to London, Paris, and Vienna. Last summer, they took a two-week cruise on their boat up to and around Penobscot Bay. In January, they visited New Zealand and Australia.

Jay Lathrop and his wife, Sally, built a retirement home (solar powered) on 30 acres in the northwest corner of South Carolina on Lake Keowee within sight of the Blue Ridge Mountains. Jay retired from Clemson University, where he had been professor of electrical and computer engineering since 1968. From 1952-58, he was a physicist at the National Bureau of Standards. Then from 1958-68, he was engineer and manager at Texas Instruments. Jay's career has been dominated by the integrated circuit. He is proud to have participated in its evolution, first as a developer of technology and later as a teacher and researcher (reliability). Even in retirement, the ubiquitous little beast plays a significant role via consulting and adjunct educational activities.

Jay had heart attacks in 1962 and 1972. In 1982, he had a sextuple bypass operation and now is literally a new person, who can participate in any activity as well as anyone of his age. His weight is unchanged from college years, but his cholesterol is too high despite becoming a vegetarian six years ago. In 1985, he acquired a second family by marrying Sally. The total progeny is six children and three grandchildren.

After graduation, George Lim stayed on for an M.S. in biology in 1949. After medical school, he

did a year each of rotating internship (internal medicine and general surgery) followed by three years of residency training in orthopedic surgery. He began private practice in Rome, N.Y., in 1959 and has been there ever since. He writes that his orthopedic surgery practice combines many of the skills he learned at Tech together with those acquired in medical training. He is active in medical organizations. He has been an officer of the Medical Society of New York, a delegate to the AMA, a past president of the New York Society of Orthopedic Surgeons, and is clinical professor of orthopedic surgery at the Health Science Center in Syracuse, N.Y. George and his wife, Beverly, have five children, including a professional dancer, an orthopedic surgeon in sports medicine, a computer system salesman, a space scientist, and a medical doctor.

Looking back at his days at Tech, George has come to regard that experience in a progressively more warm and favorable light as he realizes that MIT gave him much more than he appreciated at the time.—Marty Billett, secretary and president, 16 Greenwood Ave., Barrington, RI 02806, (401) 245-8963, 245-0166

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Please send news for this column to: **Fletcher Eaton**, secretary, 42 Perry Dr., Needham, MA 02192, (617) 449-1614

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Please send news for this column to: **John T. McKenna**, secretary, 182 Midpine Rd., P.O. Box 376, Cummaquid, MA 02637-0376

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Most of you are unaware of the traditional MIT alumni/ae baseball game. The second of these annual games, pitting the varsity against the alumni/ae, was held last September. It celebrated the 40th year of baseball at Tech. The alumni/ae won 5-3, and one of the stalwarts was our **Peter Philiou**. Pete, playing third base, sent us a note of how he had to throw to the shortstop in order to get the ball to first base.

We received word of the promotion of **Frank R. Tully** to the position of executive vice-president directing Human Resources and Total Quality Systems at the Goodyear Tire and Rubber Co. in Akron, Ohio.

Sadly, we have been notified of the passing of **William D. Pinkham** last November. He had been living in Short Hills, N.J. He was the president and owner of Pinkham Trane Service, Inc., a company involved with air conditioning equipment. We express our condolences to his wife, Sybil, and his three children.—Martin N. Greenfield, secretary, 25 Darrell Dr., Randolph, MA 02368

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Arthur Auer, M.D., writes that he is still practicing vascular and general surgery in St. Louis County. He is head of vascular surgery and director of the non-invasive blood flow laboratory. He says they are utilizing three-color images. Finally, in his spare time, he took a vacation to mainland China two years ago and last year went to east Africa, where he spent two exciting days tracking gorillas. At least, I think that is what he said; you know how it is with doctors' handwriting.

Two Course V classmates have won highest honors. **Dana Mayo**, professor of chemistry at Bowdoin, is co-winner of the Bowdoin Prize, the college's highest honor, for his work in developing the microscale organic chemistry apparatus and curriculum that is being adopted all over the country. . . . **Lloyd Currie** has received the Commerce Department's Gold Medal, its highest

honor, for "insightful seminal contributions to measurement science in atmospheric chemistry and the evolving field of chemometrics." Chemometrics is a buzzword for the application of mathematical and statistical techniques to the analysis of chemical data.

For several years, I have been mentioning the number of papers that **Art Freeman** has co-authored for the March meeting of the American Physical Society. This year he submitted 13, down a little from previous years, all on the calculation of electronic and physical properties of solids.

This year, some of the papers concern the computation of surface properties instead of just bulk properties. Art teaches physics at Northwestern.

As Shakespeare did not quite say, "Be not afraid of retirement: some men are born retired, some achieve retirement, and some have retirement thrust upon them." In mentioning **Don Grine's** achieving retirement recently, I omitted to mention his previous achievement of being general manager of S-Cubed Division of Maxwell Labs.—**Richard F. Lacey**, secretary, 2340 Cowper St., Palo Alto, CA 94301

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Richard Landy, vice-president of technology for North American Refractories Co. in Cleveland, Ohio, has been named a 1989 recipient of the American Society for Testing and Materials (ASTM) Award of Merit. The award of merit recognizes marked leadership, outstanding contributions or productive service to ASME. The award was presented at a fall meeting, and he was cited for outstanding contributions in advancing the uses of statistical procedures in sampling and testing, and quantifying precision and bias statements in test methods. In addition to an SB degree in geology from MIT, Richard has MS and PhD degrees from Penn State University, both in mineralogy. He worked with Carborundum Co. prior to joining American Refractories Co. in 1967. He was promoted to vice-president in 1989. He has been a member of ASME for 19 years and is also a member of the British Ceramics Society.

Sidney Gravitz is in his 30th year with Boeing. Previously, he was employed with North American Aviation, MIT, and the U.S. Air Force. He has had assignments in military and commercial aircraft, as well as tactical and space systems. He is currently working as the AWACS (Airborne Warning and Control System) enhancements manager.

Five years ago, **Yechiel "Jack" Shulman** moved from Chicago to Minneapolis. He now holds the William R. Sweatt Chair in Technological Leadership at the Institute of Technology of the University of Minnesota. He is directing a new program in management of technology. He and his wife, Ruth, have five grandchildren, three in New York and two in Milan, Italy. He says he uses their location as an excuse for traveling.

Wolf "Bill" Haberman has been traveling, to say the least. He and Berna had quite an experience in the People's Republic of China in the period May 22 to June 8, 1989. They were in Tiananmen Square four days before the troops and tanks took over. He says that, although the takeover was a terrible event, they found the Chinese people and guides to be very friendly and the country spectacular. They traveled over 3,000 miles from Shanghai to Beijing, to Xian, to Kuming, to Guangzhou, and on to Hong Kong with several stops in between. It was a great adventure. He also announced two more grandsons born this year, their second and third.

In a prior column, I suggested that those taking particularly interesting trips might be persuaded to bring slides to the next reunion. Bill's trip would seem to fit in this category. Let me know, Bill, if you could be induced to share your experiences with us.

All of you out there, keep up the good work with the personal items. Keep thinking about the reunion. We are almost halfway there.—**Gilbert**

"**Gil" Gardner**, secretary, 1200 Trinity Dr., Alexandria, VA 22314, (703) 461-0331 (The recorder at this number in my home has a message for my wife's company, Arcadia Realty. Leave your name, phone number, and mention your MIT '53 affiliation. I'll get back to you.)

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You will be reading this after the reunion has been held, but as you know this is prepared before the reunion. Therefore, it is the calm before the storm—not a great deal of information now, but I'm sure a flood of information will be available later.

Frank Buck informs us that he is managing five (soon to be six) cyclotrons for Du Pont in Billerica, Mass., making radioactive pharmaceuticals. He has been there for 21 years, with four to go for retirement. Frank has six children, three still in school and two at home. . . . **Bill Deibel** states that he and Karel passed two milestones in November 1989. Their oldest daughter, Marjory, was married, and a younger daughter moved out of the house, thus creating an empty nest for the first time since 1963. . . . **Gordon Lohman** continues in the news with his election to the board of American Brands, Inc. He is president and chief operating officer of Amsted Industries, Inc., in Chicago, Ill.

Bob and I are getting to the end of the line as your class secretaries. We appreciate all the information from our fabulous class. I wish all of you happiness and continued success in the future.—co-secretaries: **DuWayne J. Peterson**, 201 E. 79th St., Apartment 11-1, New York, NY 10021; **Robert P. Greene**, 100 Memorial Dr., Apartment No. 11-2A, Cambridge, MA 02142

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Irwin Dorros of Morristown, N.J., was one of 80 engineers to be inducted into the National Academy of Engineering (NAE) in 1989 for "leadership in the development of public telephone networks, Integrated Services Digital Network, and the management of major telecommunications research." NAE is chartered under the National Academy of Science and advises the government on questions relating to science and technology. Irwin has served as Bellcore's executive vice-president of technical services since 1984, providing technical support to the divested Bell telephone companies. He started his career at Bell telephone in 1956 and became assistant vice-president of network planning at AT&T in 1978, responsible for planning the evolution of the then nationwide Bell telecommunication network. Dorros received a doctor of engineering science degree from Columbia in 1962. He is on the board of directors of Bellcore, Microelectronics and Computer Technology Corp., and Vertex Industries, Inc.; a member of the New Jersey Institute of Technology's board of overseers; chairman of the systems subcommittee of the Federal Communications Commission's Advisory Committee on Advanced Television Services; a fellow of IEEE; and he holds five patents.

Stuart Frank, MD, has become dean of students, at Southern Illinois University, in addition to being professor and chief of cardiology. Stuart earned his medical degree at New York University; completed residency at Yale-New Haven Medical Center; and received fellowships at the National Heart Hospital, London, and the National Heart Institute, Bethesda. Prior to joining SIU, he was clinical assistant professor at the University of California, San Francisco, Medical Center and chief of cardiology and director of the coronary care and intensive care units at the Kaiser Foundation Hospital in San Francisco. He is a diplomate of the National Board of Examiners, American Board of Internal Medicine, and American Board of Cardiovascular Diseases; a fellow of the American College of Physicians, American

College of Chest Physicians, Council on Clinical Cardiology for the American Heart Assoc., and the Laennec Society. He has received six years of research funding from the American Heart Association, Illinois Affiliate, and has served as a consultant to the U.S. Social Security Administration since 1980. Frank is married to Amber, also an MD and they have five children.

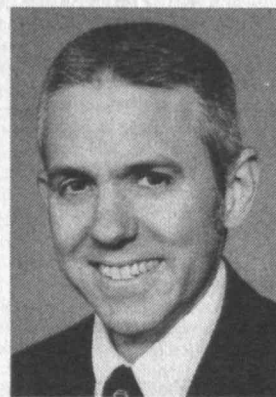
Victor Vaughan, director of the Office of Safety and Operational Readiness for the Chemical Technology Division of Oak Ridge National Laboratory, was named Outstanding Engineer of the Year by the Tennessee Society of Professional Engineers. He has worked in the nuclear energy fields of fuel processing, isotope production, and nuclear waste handling. Most of his contributions have been in peaceful uses of nuclear energy ranging from designing equipment for remote hot cell operations to setting research agendas and directing experimental studies for the reprocessing of irradiated nuclear fuels. Vaughan serves on the National Institute of Engineering Ethics and is state chairman of the Joint Engineering Action Group, a consortium of 17 professional organizations in the state. He also plays the viola with the Oak Ridge Symphony Orchestra. A little of the fifth on the forth? Have a good summer.—co-secretaries: **George H. Brattin**, 39 Bartlett St., Andover, MA 01810, (508) 470-2730; **Irwin Gross**, McGraw-Hill, 1221 Ave. of the Americas, New York, NY 10020, (212) 512-3181

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Please send news for this column to: **John Christian**, secretary, 23 Fredana Rd., Waban, MA 02168

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Our lead-off hitter this month is **Sander Weinreb**, who writes, "I've joined Martin Marietta Laboratories as a principal scientist working on millimeter-wave integrated circuits. Our son Glenn (MIT, '86) is a founder of GW Instruments, a manufacturer of Macintosh based data acquisition systems, in Boston." . . . Receiving the 1989 Computing Practice Award from AIChE was **Edgar Bristol**. Currently a consulting research engineer for The Foxboro Co., Edgar was honored for his innovations in computer process control systems. Besides having authored 80 technical publications, he holds six patents. Edgar is also a past chair of AIChE's Computers and Systems Technology Division.



Sheldon Dean

Sheldon Dean has been elected to the ASTM Board of Directors. Currently chief engineer of materials in the corporate engineering department of Air Products and Chemicals, Inc., in Allentown, Pa., Sheldon has written more than 50 technical papers and is a recipient of the Sea Horse Institute's Young Author's Award. In January, he was also named a fellow of the AIChE in

recognition of his contributions to the fields of corrosion and applied materials science. Sheldon and Linda have three grown children.

Say, comrades, it's easier to find the *Red October* than to hunt for news of the MIT class of '58. Let's spread a little *glasnost* by trading news of your activities in exchange for your name in lights in this column.—**Mike Brose**, secretary, 841 Magdeline Dr., Madison, WI 53704

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Please send news for this column to: **Allan S. Bufford**, secretary, Office of the Treasurer, MIT, 238 Main St., Suite 200, Cambridge, MA 02142

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One of the curses of publication deadlines is that, while it is early April as I am writing this column, you will be reading this after our reunion. Therefore, I hope that those of you who attended the June reunion had a great time. More on the reunion in a later column(s).

Congratulations to **Richard Blahut**, a fellow with IBM in Oswego, N.Y., who was recently elected to membership in the National Academy of Engineering. Richard was cited for his pioneering work in coherent emitter signal processing and for contributions to information theory and error control codes.

Richard Bertman was elected vice-president and president-elect of the Boston Society of Architects. Richard is a partner and principal-in-charge of design of CBT/Childs Bertman Tseckares & Casendino, Inc. Bertman has also held numerous other positions in Boston architectural organizations and is an award-winning sculptor. His work has been exhibited in galleries and museums in Massachusetts, New York, and California. Congratulations to you, too.

In December the *New York Times* reported that **Jon Shirley** retired as president of Microsoft Corp., Redmond, Wash. Jon will continue his association with Microsoft as a director and consultant.

In November 1989, the Williamstown, Mass., newspaper, the *Advocate*, reported the election of **Warren Van Genderen** as president of the Patten Corp. Patten is a firm of 660 employees specializing in the subdivision of large rural tracts of real estate for vacation homes. Warren had managed several companies including serving as president and chairman of California Windsor Corp., a financial holding company, and as owner of Yellowstone Basin Properties. Best wishes for continued success, Warren.

It is with sadness that I report the death last January 6 of **Jerome Sashin**. At the time of his death, Jerry was chairman of the research committee of the Psychoanalytic Institute of New England East. Jerry had received his MD degree from NYU School of Medicine. Jerry held teaching appointments at Harvard and Tufts medical schools. He leaves his wife, Bonnie, and daughter of Chestnut Hill, Mass.—**Frank A. Tapparo**, secretary and class agent, 15 S. Montague St., Arlington, VA 22204

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It has been a quiet month with only four small communications. You can remedy this loneliness by writing to the address below and describing your life and loves.

Ed Myers is an adjunct staff member of the Institute for Defense Analysis in Alexandria, Va. Last year, he was a member of the U.S. delegation to COCOM in Paris. Does everyone else know what COCOM is? . . . **Jerry Grossman**, in addition to being chairman at New England Medical Center, is now a director at the Boston Federal Reserve. With New England's economy in a nosedive this could be a very challenging posi-

tion. Congratulations, Jerry. . . **Hugh Willis** is now president of Chem-Cycle Corp. They work in the industrial waste prevention and recycling business from offices in Boston. . . **Lloyd Kanenberg** writes to tell us that **Don Hartill** is now a fellow of the American Physical Society—for significant contributions to particle physics.

Back on page A24 of the *New York Times* last March, there was an article about NASA's efforts to keep the space station alive following the internal report suggesting more than 2,000 hours of repair yearly would be required to keep it going. Testifying for NASA in front of a skeptical congressional committee was our own **Bill Lenoir**, who is associate administrator for space flight at NASA. According to the *Times*, Bill said NASA might have to spend a little more money to redesign the station so that robots could do the repairs rather than people. He thought about 20 percent of the parts likely to fail would have to be redone. The cost of the station program so far (six years) has been \$3.9 billion. The *Times* suggested NASA bag the whole thing and put up unmanned stations. We can look for an irate letter from NASA in subsequent issues!

That's it for now. Keep June 1991 blocked off for a trip back to Cambridge and our 30th reunion.—**Andrew Braun**, secretary, 464 Heath St., Chestnut Hill, MA 02167

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Received a nice letter from **Jeremy R. Goldberg** advising that he had seen an article about my collection of Confederate counterfeit currency in the March/April 1990 Penn State alumni magazine, the *Penn Stater*. It seems that Jeremy's wife, Marcia, is a graduate of Penn State (where I did my graduate work), and they get both *Technology Review* and its Penn State counterpart. Jeremy feels that my other MIT classmates might wish to learn about my exotic collecting interests, so I suggest that you can read my articles on the subject, if interested, in *Paper Money*, the journal of the Society of Paper Money Collectors. Jeremy says (noting that my picture indicates that we share the same condition of rising foreheads), "God made only so many perfect heads, the rest he covered with hair!" Jeremy's wife, sister, and brother-in-law are all members of the Penn State class of 1964. He mentions that their son, Eliot, is a junior at the University of Maryland, majoring in government and politics, but is spending this year at Hebrew University of Jerusalem (Israel) studying the government and politics of the Middle East. Daughter, Devra, is a "freshperson at Yale" studying calculus and physics, among a variety of other subjects (shades of our own early years at good ol' MIT). Jeremy's late father spent many years as an electronics engineer with the Navy Department, and his mother worked as a mechanical engineer prior to his parent's marriage. He supposes the entire Goldberg family comes by their interest in science and technology as a matter of genetics as well as environment.

Texas Tech University Horn Professor **David B. Knaff** was recently named chairman of the Department of Chemistry and Biochemistry. Dave received his bachelor's degree in chemistry with us in 1962, then went on to get his MS and PhD in chemistry from Yale in 1963 and 1966. He also spent two years at UC/Berkeley as an NIH postdoctoral fellow in the Department of Cell Physiology. Dave moved to Lubbock and Texas Tech in 1976. His research focuses on bioenergetics, including the study of electron transport mechanisms of plant enzymes. If any of our classmates ever see any strange glowing plant forms, they should let Dave know. Perhaps we'll read about it in the *Weekly World News*.

David W. Ellis has been selected as the new president of the Museum of Science in Boston. Dave received his PhD from MIT in 1962, and that calls for kudos in the class column. He will assume his new position in August 1990. Dave has held several teaching and administrative

posts at the University of New Hampshire, including vice-provost and vice-president for academic affairs. Born in Huntingdon, Pa. (home of generations of my own ancestors), Dave attended Governor Dummer Academy in South Byfield, Mass., and received his BA from Haverford before completing his PhD in chemistry at MIT. He also attended the Advanced Management Program of the Harvard Graduate School of Business.

Yours truly, **Hank McCarl**, has been named commissioner for the South Central United States (Tennessee, Alabama, Mississippi, Louisiana, Texas, Arkansas, and Oklahoma) for the Clan Henderson Society of North America. If you noted my earlier reference to generations of my ancestors from Huntingdon County, Pa.: these were Hendersons, Whartons, and McCardles, all of whom were among the earliest settlers of the Juniata Valley. My Henderson grandmother entitles me to wear the Henderson tartan, symbolic of Scottish family heritage. If any of you get to attend Highland games in various parts of the country, do stop by the Clan Henderson tent and say hello to my cousins. Who knows, I may even be there in my kilt and sporran with my shene dhu (black knife) tucked in the garter of my stocking. The job of clan commissioner is to organize parties (shades of Senior House), organize and discuss family genealogy, and gather the cousins to the fold. I'll never forget my first Highland games, in Antigonish, Nova Scotia. The MIT Geology Department had a summer field camp at Crystal Cliffs, north of Antigonish, and most of our class (between sophomore and junior year at MIT) rented kilts to attend the Highland ball. It has been increasingly enjoyable to celebrate the Scottish heritage ever since.

You, too, can see your name in this very column! Drop me a line when you get the chance: **Hank McCarl**, secretary, P. O. Box 352, Birmingham, AL 35201-0352

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Help! Send money if it's all you can do, but (much better) *send news*. Nothing at all in this issue's mailbag, and I know there's stuff going on. What's new at work? How are the grandkids? Are you planning a retreat in Nepal? Has Donald Trump picked you as his press agent? Whatever . . . write, phone, or wrap a note around a rock and toss it in my window. Regards—**Phil Marcus**, secretary, 3410 Orange Grove Ct., Ellicott City, MD 21043, (301) 750-0184

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Just a few items to pass along to you this issue. Last December the *Boston Globe* reported that **Paul Santos** had become the technical director of advanced development for Bityx Corp. in Southborough, Mass. No other details were provided.

Also from the news clipping service, the *Wall Street Journal* and the *New York Times* reported that **John Hanson** had left Caterpillar, Inc., to become senior vice-president and group executive of Joy Technologies, Inc., in Pittsburgh. John also was appointed president of the Mining Machinery Group, which is a subsidiary of Joy Technologies.

Roger Lewis sent in a report of his numerous activities in the architecture profession. He continues as a professor at the University of Maryland and an architecture columnist for the *Washington Post* and for *Museum News*. Roger spent the month of September in Moscow as architect-in-residence with "Design USA," a USIA-sponsored exhibition touring the USSR. He co-authored *The Growth Management Handbook* and is engaged in the planning of a 2,500-acre "new town" on the Potomac, south of Washington. Somehow Roger also finds time for tennis and skiing.

The next item I have to report actually caused a brief scare when it arrived. If you are the parent

of a college student in Nashville, Tenn., and you receive a letter from a law firm in Memphis, you get just a little bit worried. Happily, the letter was from **Ron Gilman** announcing that he had been elected a fellow of the American Bar Foundation. Additionally, Ron is being installed as president of the Tennessee Bar Association on June 22. What a story! Former class secretary makes good! Congratulations on both accounts, Ron.

Finally, an update from Col. **Joe Boling**, who was reassigned from Washington to Heidelberg to be deputy chief of staff for information architecture at HQ, U.S. Army, Europe. There, he will be responsible for long-range planning of information management for all army units in Europe, "bringing more computers to more users" in Joe's words. His son David is also in the army and had been recently assigned to bomb disposal school. His son Evan is working in Reston, Va., and daughter Margaret was completing her education degree and teaching in Indianapolis.

That's the news. Please drop a line when you get a chance. Thanks.—**Joe Kasper**, secretary, RR 2, Box 4, Norwich, VT 05055

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July column! Post reunion! I'm looking forward to the reunion now, but it'll be a memory by the time you read this. The material for this column seems to coincide with the year-end (1989) tax and charitable contribution season, so we have a few more fund envelopes than usual.

Robert Morgan sent a note pointing out that, although **Whit Diffie** appeared on the "missing alumni" list for the 25th reunion, Whit was quoted in a *New York Times* article on the trial of Robert Morris, Jr., for the creation of the Internet worm. Whit's quote pointed out that "the culture of computer security and for that matter the culture of programming does not have an ethic that says that if something is vulnerable you shouldn't investigate it." Robert also said that he's looking forward to the reunion and particularly to seeing the alumni of Florey's Fifth. . . . Speaking of computer security, **Tom Van Vleck** sent me a note along with a draft of a computer security paper for review. Tom's note said he won't make the reunion because he'll be in Europe on his second sabbatical from Tandem, but he sends his regards to us all.

Fellow civil engineer **Dave Rubin** sent what I hope was an offer to replace me as the perpetrator of this column. He also reported that Sharon's still dean of liberal arts at Salisbury State University (Maryland) and that he's traveling a lot, last year to Indonesia and Africa. Son Josh spent his high-school junior year on a kibbutz and son Ari has now completed his junior year at the University of Colorado. . . . **Eric Westerfeld** writes that he's joined Orasis Corp. of Sunnyvale, Calif., as manager of electrical engineering. Orasis is a startup that produces motion-control and inspection equipment for semiconductor manufacturing. . . . **Fred Kern** says he still works at Atlantic Applied Research Corp. as a founding vice-president, along with two fellow MIT PhD co-founders and three other cofounders. The company has grown to almost 30 employees since 1984 and specializes in acoustics, noise control, and hydrodynamics. Fred and wife Anne have a son, 11, and daughters aged 7 and 2.

Tom Callahan wrote from Bangkok that he saw **Ed Burke** there in December 1989. Both are planning to be at the reunion and Tom has to be a strong candidate for some kind of distance-traveled award. . . . **Allen Zaklad** writes that he's been married since 1974, and that he and wife Loretta have a daughter Rosie, 13, and a son Nate, 10. Allen's a psychologist and principal scientist at Analytics, Inc., where he's been for nine years. Allen and family are also planning on attending the reunion. . . . **Mary Coffey** wrote that she has transferred with Bechtel from the Boston Central Artery project to the environmen-

tal staff of Bechtel's office in Gaithersburg, Md. Mary says it was nice to get back to the Boston area after 10 years, but that she could do without the snow, ice, and below-freezing temperatures. She's looking forward to warmer weather, to say the least.

Bruce Golden was reelected chair of the MIT Enterprise Forum of Chicago for its seventh year of operations. He is still practicing corporate law in Chicago with McDermott, Will, and Emery. The big news is that Bruce was married for the first time in December. His wife, Judy Rosenbaum, is a native Chicago beauty and also a lawyer. . . . **Lou Kleiman** says that although he made the final three, the F.A.A. failed to select him as its first assistant administrator for Science and Advanced Technology. Accordingly, he's resumed his aviation and air traffic control automation consulting practice with clients including MIT Lincoln Labs, T.R.W., Hughes Aircraft, System Resources Corp., and Kendrick and Co.

Yazan Sharif is still president of Harbison-Walker Refractories of Pittsburgh, Pa., with 12 operations in the U.S. and Canada as well as affiliates around the world. Yazan says that 1989 was a busy travel year, with two separate trips that took him to Japan, Thailand, Australia, and New Zealand. Yazan's wife Linda is "believe it or not," a first-year law student at the University of Pittsburgh. Daughter Yasameen will head for Tufts in the fall, and son Sayf rows in high school and will be in the Head of the Charles Regatta in the fall. So Yazan looks forward both to more frequent trips to the Boston area and to having three college students in the family in two years.—**Steve Lipner**, secretary, 6 Midland Rd., Wellesley, MA 02181

66

Martin Kaliski has been named to a three-year term as chair of the Electrical Engineering Department of California Polytechnic State University. He lives in San Luis Obispo with his wife, Judith, and their four children. . . . **Stuart Madnick** has been named the first John Norris Maguire Professor of Information Technology. He has been a member of the Sloan School faculty since 1972. . . . **Judith Perrole** has been a visiting scientist at the Harvard School of Public Health for the past academic year. She is studying changing public and regulatory perceptions of the health hazards of electromagnetic fields, and developing curriculum materials to include occupational health and safety issues into engineering design courses.

Meanwhile, my house is being renovated, and the dust is everywhere. The word processor is going into a large baggie tomorrow and staying there until the air clears. More news next time.—**Jeff Kenton**, secretary, 7 Hill Top Rd., Weston, MA 02193

67

Jeff Schoenwald is manager of a department at the Rockwell Science Center that is doing research on smart structures, non-destructive evaluation, and process control sensors. He has also been quite deeply involved in robotics. With peace breaking out, Rockwell, like many companies, has been re-examining its business strategy, and Jeff has been spending more time addressing technological issues arising in the commercial sector of Rockwell. He writes, "I expect many of my classmates in the aerospace-electronics-DOD environment are feeling the same winds of change, and I would like to hear from them about it. Perhaps *Technology Review* would consider establishing a letter forum for alumni to express their concerns, experiences, and actions in light of the current global political and economic situation." (Editor's Note: Concerns related to MIT may be submitted to "Letters" in this section.)

Jeff and his wife Sheri, a school psychologist,

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have two children, ages 6 and 9. Jeff notes that he and his children are active in YMCA, Indian Princesses, and Trailblazers—"How-How!" He asks if anyone relates to that? Jeff writes, "I had the pleasure in January of attending three consecutive YMCA snowcamps—the mattresses in college were never so bad! Snowcamping in southern California is interesting in that you can go play in the snow, then drive home and mow the lawn."

Fred Goldman and Melody Marks were married at the Mark Hopkins Hotel San Francisco last August. Classmates attending the ceremony included **Eddie Kirsch**, **John Hiatt**, and **Bill Murray**. Fred is CEO of Spot Systems, Inc., a computer software company specializing in multi-currency software for international banking, multi-national corporations, and foreign exchange traders. . . . **Jim Sutton** is manager of research and development for a group developing software for computer integrated manufacturing at Hewlett-Packard. Jim and his family recently moved to Sunnyvale, Calif.

Stan Rose writes that he has recently taken on a new assignment as technical architect at Bankers Trust, where he has completed 12 years. He is responsible for creating, and ensuring compliance with, a corporate technical strategy. A principal area of concentration is the 100 plus DEC systems in their global markets (i.e., trading, investing) business line. Stan and his wife, Louise, recently completed a major project—they built a new home in Lawrenceville, N.J. They are currently investigating colleges for their daughter. Stan's MIT activities include running the New York City Alumni Fund telethon and managing the bank's recruiting effort at the Institute. This provides Stan the opportunity to visit the campus a few times a year. Notwithstanding all the changes at MIT, Stan reports that Building 10 still looks the same.

A **Gardiner Gay** memorial scholarship fund has been established, and donations can be directed

to Ben Krafsig, 20 Juniper Brook Rd., Northboro, MA 01532.—**Jim Swanson**, secretary, 878 Hoffman Terr., Los Altos, CA 94024

68

The mailbox has been pretty empty the past three months. Even now, there is barely enough for a column, but in fairness to the folks who have written, we want to report the news we do have.

James Just reports that he is currently associate department head at Mitre Corp. for Strategic Defense Systems, working with the Army to upgrade their echelons-above-Corps command and control systems—a very large Ada development project, among other things. He still lives in Tysons Corner, Va., with his wife, Janet, and children, Christopher (9) and Molly (3).

Paul Ware writes that he is “still alive and well and living in Stoughton.” He has been vice-president of Quality Assurance for Kiddie Products, Inc. for four years now and still loves it. He and his wife, Carol, have been married for 18 years. Their son, Erik, is a senior at University of Massachusetts, Amherst; their daughter Jennifer is 16 and thinking about MIT for college. Paul is still active on the board of directors of the American Society for Quality Control.

Barry Mitnick reports that he spent the year “mostly keeping the piles on my desk and the kitchen counter from falling over.” He is still at the Katz Graduate School of Business at the University of Pittsburgh, where he coordinates the interest group in his area. His youngest, Michael, entered kindergarten this fall, and his twins, Jenny and Jeff, are in fourth grade in their respective schools. His wife, Margy, “continues to be active in promoting seat belts on school buses despite a faulty federal report on the topic that did not help advance safety in the area.”

Thomas Romer is back at the Graduate School of Industrial Administration, Carnegie-Mellon University, after a year on leave at Stanford University. . . . **Fereydoon Abtahi** reports, “Eleven years of MIT was not enough, so I went to Suffolk Law School to get a law degree.” He is currently involved in expert testimony for products liability and marketing research for technology products for European companies. “And, yes,” he concludes, “I am self employed.” . . .

Ron Rosen reports that not much is new in his work; he and his wife, Marilyn, continue with their computing business. But on the avocational side, he is now chairman of the Boy Scout Troop Committee, “a change,” he indicates, “after four years as scoutmaster.” Ron’s younger son, Bobby, age 11, will be joining soon. Their older son, Alvin, age 15, just made the high school JV basketball team.

Stephan Reimers writes, “For about the past 12 years, I have been chairman of the subcommittee on piping for the ASME’s safety code committee in pressure vessels for human occupancy (PVHO). In the summer of 1989, the PVHO piping rules (written largely by myself) were finally published by ASME.” These rules are now effective.

Pete Amstutz is now assistant treasurer for NCR Corp. in Dayton, Ohio, responsible for all debt issues, foreign exchange, and bank relations. “After working in banking for 13 years,” he writes, “it’s fun to be on the other side of the desk.”

A clipping from *Southern Textile News* reports that **Judd Schwartz** was recently promoted to the position of technical director for Allied Fibers’ Home Furnishings Group. In his new position, Judd will have responsibility for the direction of all process and product development activities within the home furnishings business. He has been with Allied since 1972.

We have a report from the *Wall Street Journal* that **Scott Marks** has recently assumed the title of executive vice-president of First Chicago Corp.; he also continues as chairman of First Chicago Corp.

For anyone with news to report, this would be a good time to drop us a line.—**Gail and Mike**

Marcus, secretaries, 8026 Cypress Grove Ln., Cabin John, MD 20818

69

Let’s begin with a lovely letter from **Susan Udin**, that shows how important a class reunion can be: “David (‘66) and I have been living in Buffalo, N.Y., for 10 years now. Despite the city’s reputation, it actually is a very nice place to be, with lots of wonderful architecture and a great art museum. The winters are long, but they’re no big deal after 12 years in Boston. I’m an associate professor of physiology in the Medical School of SUNY at Buffalo. I do research on the mechanisms by which early sensory experience influences the formation of orderly connections in the developing brain. David and I adopted two wonderful kids from Korea four years ago. Rachel, now 9, is curious about everything, from why some people are greedy to whether rhubarb is related to celery. Michael, now 7, is gradually expanding his interests from cars, cars, and cars, to selected aspects of the rest of the world. We first came to consider adopting Korean children at the class of ‘69 15th reunion, where we met **Alan Millner** and his wife, who generously took the time to tell their own experiences. Many thanks to them!”

Richard Kremsdorf is now practicing pulmonary and critical care medicine at Mercy Hospital in San Diego, and is teaching part time at the University of California San Diego School of Medicine where he is associate clinical professor of medicine. As medical director of Clinical Information Systems at Mercy Hospital, he is developing hospital computer applications for clinicians. Richard also does consulting work in medical computing. He and his wife Deborah live in San Diego with their 11-year-old daughter Robin. . . .

Mike Laird, another Californian, writes from Manhattan Beach: “Moved to Los Angeles and am now enjoying uniquely California activities, like professional sand castle contests. I’m managing a family of real-time financial software products at Quotron Systems.” . . . **Walter Klos** is the senior vice-president of operations for Data Chromatics, an information integration and color graphics firm in Towson, Md. In addition to an SB from MIT, Walter received an MBA from Loyola College in 1985.

Peter L. Eirich and Leigh (Dresser) Eirich, ‘70, are still living in Columbia, Md., where they have been joined by “three delightful new additions”: Gaia (6), David (5), and Sharyn (1). Pete works for Westinghouse and participates in the development of the national Product Data Exchange Specification. . . . **William T. Stewart** and his wife Jennifer recently had their fifth child, David Tanner. Bill writes from Zanesville, Ohio, “We really enjoyed our 20th class reunion, combined with a family trip to Plymouth and New York City.” Bill combines engineering and business acumen in his family business. . . . A brief note in the *New York Times* says that **Alan Curtis Huber** is now director of Harris Corp. in Melbourne, Fla.

We end with a not-so-uplifting message from **Kathryn K. James**: “I really enjoyed the reunion. I especially enjoyed seeing Mr. Tucker and his assistant, Lydia, at the EE Department. When I returned home, my company sent me on 30 days leave and asked me to prove that I was sane so that I could return to work. Fortunately, I was able to do that. However, my career is probably ruined. Hope 1990 is better.”—**Eugene F. Mallove**, secretary, 171 Woodhill-Hooksett Rd., Bow, NH 03304

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Steve Cushing of Jamaica Plain has been named visiting associate professor of computer science at Boston University’s Metropolitan College. Steve is an expert in linguistic and cognitive factors in

aviation safety and has taught part-time at Metropolitan College since 1985. He received bachelor’s degrees in mathematics and humanities from MIT and a master’s and a doctorate from the University of California at Los Angeles. . . . **Frank Pompei** is founder and president of Exergen Corp. in Natick, which develops, manufactures, and markets innovations in infrared scanning products. . . . **Sydney V. Jackson** is now in his second year of a three-year course of study as a student at the San Francisco Theological Seminary, studying to be a Presbyterian minister.—**Robert Vegeler**, secretary, Beers, Mallers, Backs, Salin & Larmore, 1100 Ft. Wayne Natl. Bank Bldg., Ft. Wayne, IN 46802

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Plans are already being made for our 20th reunion in 1991. If you are interested in working on the reunion, please contact David Libby at the MIT Alumni/ae Association, (617) 253-8200.

Zane Segal is the president of the Houston Association for Film and Television, a nonprofit corporation to educate people and promote the booming film and television industry in Houston. . . . **James A. Bricker** is the chief operations manager of Capitol Circuits Corp. in Allston, Mass. He was formerly president and chief executive officer of Defense Technologies, Inc. in Bedford, Mass. . . . **Robert H. Price** is working for JAYCOR in its Albuquerque office as senior principal scientist carrying out experimental and theoretical work on the interactions of high power microwaves with complex electronic military systems. He recently developed a fundamentally new theory to describe these interactions, which shows remarkable agreement with experiment. His wife, Connie, is a very successful real estate agent in Santa Fe, “a wonderful place to live and a unique lifestyle.” Robert says, “Many thanks to MIT for making it possible for us.”—**R. Hal Moorman**, secretary, P.O. Box 1808, Brenham, TX 77833

72

Hi! I’ve got only a little news to report this month. **Augusto Dias Carneiro** reports from Rio that, as of January 1990, his company changed its name to Zatech. “It means ‘financial engineering’ in Japanese, and the restructuring of Brazil’s foreign debt allows plenty of space for that!” He has also been writing self-instruction manuals for Citibank’s branches in Latin America. . . . **George Lawrence, Jr.** is the interim chief executive of Texas International Co and continues to be the CFO and general counsel.

I saw **Riccardo Dicapua** very briefly in March in Miami. He has bought a business there and recently moved his family into a new house that sounds great. The family is enjoying life in America, and Ric is enjoying running his company. . . . **Arthur Hellman** has joined Pennsylvania Hospital as a surgeon in the cardiothoracic area.

That’s it for this month’s news. Not much, so please send us more news and have a great 4th of July picnic.—co-secretaries: **Wendy Elaine Erb**, 6001 Pelican Bay Blvd., Apt. 1003, Naples, FL 33963; **Albion Fletcher, Jr.**, 135 West St., Braintree, MA 02184

73

Two days ago I completed a book of special interest to our class, because it was written by **Peter Huber**, a senior fellow at the Manhattan Institute. The book is titled *Liability*, and is published by Basic Books of New York. The subject, naturally, is liability law, but most particularly the de-emphasis on the influence of contract and consensual agreement over the past 30 years, subjugated by an overemphasis on tort in today’s courts. We complain often, I believe, about the ef-

fect today's litigious society has on decreased competitiveness, soaring insurance costs, and defensive practices in daily life. Peter's book documents the efforts of a handful of lawyers to create a better society, unwittingly giving us the problems above. His solutions are to-the-point and promising. Bravo.

Peter Stiller writes that he spent last year at the School of Mathematics at Princeton's Institute for Advanced Study, having now returned as a professor at Texas A&M. He is involved with a high-tech startup called Geometrix R&D, doing consulting and software development. . . . **Wes Grandmont** was elected president of G2S Constructors of Gilford, N.H., a builder and maintenance firm for industrial facilities.

John Sweeney was elected to the board of directors of the Mass. State Science Fair, Inc. He is director of education for the Draper Labs and a lecturer on the MIT faculty. . . . **John Mallick** has joined GE's Research and Development Center in Schenectady, N.Y., as an electrical engineer. He first joined GE in 1979. . . . **Tom Stagliano** is setting up a fund in memory of Santo ("Sam") Benichasa (1939-1976), whom many of us (yours gratefully included) recall as the founder of the summer community softball program at MIT, and a great motivator on campus for students in general.

Please keep this column active, friends. We probably hear from no more than 5 percent of the 1973 grads in a decade, and we want to know your exploits, so don't be a 95 percenter—write!—**Robert M.O. Sutton, Sr.**, secretary, "Chapel Hill," 1302 Churchill Ct., Marshall, VA 22115

74

If you haven't received a birthday card from me and the Class of '74 this year, either you haven't had a birthday yet this year or you threw the card out thinking it was junk mail. It does kind of look like one of those "Time-Sharing in Beautiful Boca Raton!" come-ons. If your birthday is yet to be, watch for it!

If your birthday card arrived, but it wasn't near your birthday, then MIT doesn't know your exact birthdate. Perhaps the next time you post a note to me, you could include your birthdate, please? Then you can look forward to your card next year.

Three letters received in response to birthday cards populate the column this month. Hello to Terri and **John Viggers!** . . . **David Alexander** is very busy with Opal Computing, his own computer consulting company. He, his wife, and son hail from the Bellerose, N.Y., area.

Marcy and **Tom Wolff** built themselves a larger house in Lilse ("rhymes with 'style'") Ill., last year with enough room for youngsters, Ilana and Joey. Tom's started a new position in the Information Retrieval and Analysis Group at Amoco Chemical Co. in Naperville. "I'm well convinced that it and I are a good match."

Oxymoron of the Month: Luxury Motor Coach. Write me before this madness goes out of control!—**Lionel Goulet**, secretary, 115 Albemarle Rd., Waltham, MA 02154-8133, (617) 899-9694

75

A very short column this month: **Patricia R. Calahan** had her second child, Kevin, last August. She has returned to work at Fargo Bank. Pat is finding her work and mothering a 4-year-old and an infant "challenging."

So how about some news from the rest of you?—**Jennifer Gordon**, secretary, 18 Montgomery Pl., Brooklyn, NY 11215

76

The news this month is extremely sparse. Please write. We urgently need the news.

Chris Karpal was married in August to Lucinda Scharf. The wedding was on Keuka Lake in upstate New York. . . . Arrowstreet, one of Boston's ten largest architectural firms, has named several classmates as partners: **Daniel Dyer**, **Brad Edgerly**, and **William Spears**. Congrats.

As for your secretary, he has a son, Samuel M.S. Carp. We continue to live in Woodmere, N.Y. On the business front, by the time you read this, Voice Recognition Technologies will have hopefully filed all the patents necessary and have begun shipping our large vocabulary, quasi-speaker independent, voice recognizer, called the Scribe. In short, a dictating typewriter. Developments in this entire field are interesting, especially when you consider that your secretary is in direct competition with the "Tute in their voice recognition efforts. I suspect that they may have lost the race but will only know for certain after these notes have been printed. We have the benefit of several major breakthroughs, rather than small step incremental improvements, which is the more typical case. However, market acceptance is a different story, regardless of the quality of the technology. After English, we will be doing Japanese. Their word processing remains in a very primitive state due to their highly ideogrammatic language. Our technology should revolutionize word processing in Kanjii (formal Japanese).

On the futures front, we continue to have volatility in the dollar, interest rates, gold, coffee, sugar, and cocoa. The world remains a highly nervous place. With nervousness comes a need to use futures to hedge price risk. An uneasy world is good for business!

Please send news. We do need it.—**Arthur J. Carp**, secretary, Stalco Futures, Inc., 254 West 35th St., 16th Floor, New York, NY 10001, (212) 736-1960, Fax: (212) 736-3664

77

Greetings, classmates! Here is the latest news. **Joe Egan** is an energy lawyer for LeBoeuf, Lamb, Leiby & MacRae in New York City. His wife, Sheila, was expecting their first baby in March. Write again, Joe, to let us know all about him/her!

Stephen W. Keith is a lieutenant commander in the Navy stationed on board the U.S.S. *Arkansas*, a guided-missile nuclear-powered cruiser. He serves there as chief engineer. Stephen was planning to be married this past May in Seattle to Cele Sweeney, his former Sigma Chi chapter sweetheart. He expects to be re-assigned later this year to another ship in San Diego, where he will be executive officer.

Daniel Nolet writes that he and Teresa, '78, recently moved with Corning, to Kentucky. He is fusion development manager working on liquid crystal display substrates, and Teresa is supervisor of process engineering in the Harrodsburg plant. Their two daughters have adjusted well to the move, and Daniel thinks that they will easily become southern belles.

Eileen (Schaffer) Vergino e-mailed me an update on her life. She is still living out in the "Bay Area," or to be more exact, the central valley. She reports, "I'm still at Livermore Labs, where I am working in the Treaty Verification Program as a seismologist. I am heading up the data base effort and most of my research is on yield estimation using regional seismic data. I have two children, Melissa, who just turned 8 and is in the second grade, and Adam, who is 6 and is in kindergarten. I'm still running about 20-30 miles a week depending on my schedule, which is very hectic, and I bicycle in the hot weather. I travel quite a bit. In fact, I get to see Jim Moody, '75, whenever I am in Washington, D.C. In addition, I just completed my term as co-chair of the Livermore Expanding Your Horizons Conference. Coupled with this is gymnastics, Brownies, T-ball, etc. I am also an educational counselor in Livermore for MIT. I do see Steve Rice, '78, occasionally

running at work. We usually yell across the road to one another." . . . I strongly recommend using the e-mail route to report your latest exploits. It's fast, it's easy, and it gives my husband, Paul, something special to take home to me from work. Of course, the more conventional routes are also acceptable. Mail should be addressed to **Ninamarie Maragioglio**, secretary, 8459 Yellow Leaf Ct., Springfield, VA 22153-2522 or send e-mail to hertz@ccf3.nrl.navy.mil (internet)

78

This month we hear from a few classmates (the rest of you—send in your news!). . . . **Bill Fejes** writes us from Buxford, Mass.: "This past summer, Althea and I had our second child, Stephanie. We now have two girls. Our older girl, Jessie, just turned 2. I'm working in Charlestown at IMEC Corp., a subsidiary of Pacific Scientific, as VP of engineering. I recently talked with **Kevin Hotvedt** who is busy with his company, Anafaze, in sunny California."

In December, **Susan (Frank) Dechant** was appointed to the Stow (Mass.) Planning Board, according to a clipping from the town's newspaper. In this role, Susan says she will be focusing on educating the public and on clarifying the town's planning bylaws. Susan graduated from Boston College Law School in 1984 and is now working for the Boston firm of Bowditch and Dewey.

Congratulations go to **Bruce Nemlich** and wife, Else Heinsen, who have a new baby, Brian Joseph, adopted from Chile; a new home, a log house overlooking Lake Dutchess in Holmes, N.Y.; and Bruce has a new job, Strategic Services at Anderson Consulting, Financial Services.

Jim Spohrer brings us up to date on his activities: "I completed my PhD in computer science from Yale in 1989, then spent the summer as a visiting scholar at the University of Rome in Italy. I'm now working at Apple Computer in Cupertino, Calif., as a research scientist doing artificial intelligence and education research in the Business Learning Research group. Mark Miller (MIT computer science PhD) is manager of the group. My wife, Diane Dobson, and I are just getting settled into our new home in Santa Clara, Calif. Old friends, please come visit!"

Your class secretary and wife, **Diane Curtis**, traveled to Boston in early February for business and for some MIT activities. It was pleasing to return to the area. One of the best parts of our Valentine's Day escape to Portsmouth, N.H., was a surprise encounter with **Debra (Abbott) and Skip Page**, who were celebrating Valentine's Day at the same Japanese Restaurant we were. Skip is now president of CGC/Newmarket Printing, the leading commercial printing house in Portsmouth. Deb, who works at CGC "doing anything that needs to be done," gave us a tour of the place the following day. It was exciting to see the technical advances in printing that are occurring. Deb and Skip have a handsome son, 2-year-old Evan.

Rich Perlstein writes us from San Francisco with good news: "Yes, it's true! After countless years of bachelorhood, I'm finally throwing in the towel. I'll be marrying Susan Felsenthal in Chicago on April 28 of this year. We hope to eventually find a (marginally) affordable house in either Oakland or San Rafael; until we find this holy grail, however, we will live in San Francisco. Professionally, I've spent the past year designing home additions, renovations, and new custom homes. Quite a change from commercial architecture: far less stressful to my system, and more rewarding in the level of design detail required. My next move is, hopefully, to design and finance a house for fun and profit."

That's all the news from classmates this month. Here in Ohio, we have been putting many miles on the car looking for our farm. Stay tuned.—**Jim Bidigare**, secretary, 2470 Billingsley Rd., Columbus, OH 43235, (617) 889-1817; **Julie Kozaczka**

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Astrid Howard writes, "I am currently in my third year of studies of directing for the theatre in Brussels, Belgium. I am enjoying myself and have also discovered radio! All interest in geology, which was my subject at MIT is not lost. I do translations and corrections of scientific manuscripts (from French into English) and have worked as a technician at ULB (Universite Libre de Bruxelles) Meilleure Voeux 1990." . . . From **Richard Kuntz**: "1989 presented me with a career move as well as a physical one. After more than five years with an investment subsidiary of Prudential (Prudential Capital), I joined 3i Capital as vice-president in January 1989. 3i Capital is a U.S. investment operation for the U.K.-based venture capital firm of 3i Group PLC. Our focus is on investments in established growing businesses needing capital for expansion, acquisition, recapitalization, or management buyout. Since 3i Capital's West Coast office is in Newport Beach, Calif., a relocation to Orange County from Redondo Beach was warranted." . . . **James Fujimoto** was awarded a National Academy of Science Award for Initiatives in Research for "contributions to femtosecond quantum electronics and applications of subpicosecond lasers to studies of electronic materials and biologic tissues." James is an associate professor of electrical engineering and computer science at—you guessed it!—MIT.

As for your indefatigable secretary, I played the female lead in "The Man Who Came to Dinner," a Kaufman and Hart 1930s comedy, in March (suffering a bout of laryngitis during the week between performances), then launched into rehearsals for the musical "No, No, Nanette," doing the role that Ruby Keeler played on Broadway—tap-dancing solos and everything! We open in three weeks, and much as I love the theatre, I am already dreaming about how wonderful it will be, after four straight months of rehearsing and performing, to have nothing to do! (I'm sure I'll be bored within a week, but from this vantage point, it seems like heaven!). I'll give you an update next month. By the way, some of you more observant classmates may have noticed that my address has changed. The post office was a little unreliable in forwarding my mail for the first few months, so if you wrote directly to me (not to the Alumni/ae Association) between November and March but have not yet seen your name in print, please write again.—**Sharon Lowenheim**, secretary, 98-30 67 Avenue, Apt. 6E, Forest Hills, NY 11374

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Please send news for this column to: **Kate Mulroney**, secretary, 118 Riverview Ave., Washington Crossing, PA 18977

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Hello everybody. I hope that you are having a nice summer. . . . A wonderful surprise in the mail this month was "The Adventures of Super Mom," by super mom herself **Susan Flint Barr**. In this comic, Super Mom is busy with kids and husband John as she toils through her "never-a-dull-moment" day. I am sure a lot of us can relate to super mom's daily routine! Susan reports that nothing deserving of *Technology Review* is happening at her home but that Super Mom lives up the day! . . . The *Review* sent me the contents page of **Michael Brower's** new book, *Cool Energy*, the renewable solution to global warming. We look forward to more information from Michael. . . . **Jeanne Scott** writes that she is

taking a sabbatical from working in an urgent care center in California as a "Doc-in-the-Box" to accompany husband Patrick Barron and their children, Petra (5) and Alex (2), on a two-year assignment to Tokyo with Sun Microsystems.

Thomas Semple writes that he has been working now for one-and-one-half years in Houston for Shell Oil. He reports that there aren't too many true Texans in Texas but that he has met a few in the country-side. . . . An anonymous classmate wrote to say that he is now happily married to Edna King (Wellesley '81). Congratulations, and please let us know who you are! . . . **Dave Kates** married April Fischer in March 1990 in Washington, D.C. Dave is still enjoying his career at Ernst and Young in health information consulting, advising hospitals on computer application and telecommunications. He says that he is still running and may try again next year at the Boston marathon. Congratulations to you and April and to **Philip Hood** and Christine Ausnit who were married on June 6, 1988, and had their first child this spring. The Hoods are living in McLean, Va., where Philip works at a software productivity consortium. . . . Also congratulations to **Josip Loncaric** and his wife, who had their first child in March 1990. Please send details.

Victor Miler writes that he continues to work as a systems engineer for Loral Electronics in Yonkers, N.Y. . . . **John Card** reports that he recently completed his postdoctoral year in France and has begun his permanent job at Bayer in Leverkusen, West Germany. . . . **Perry Justesen** is working at Eaton Corp and has three sons. The oldest is a first-grader. . . . **Daniel Groubert** is an assistant professor at the University of South Florida and an attending cardiac anesthesiologist at Tampa General Hospital.

Please keep those cards and letters coming. Also, please let me know if you would like to write a guest column. Take care and Happy Summer!—**Lynn Radlauer Lubell**, secretary, 2380 NW 41st St., Boca Raton, FL 33431

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It's either feast or famine. After months of no news, the mailbox is overflowing. Let's start with the marriage reports. **Keith Woodworth**, who got married in July 1987, is living in Arlington, Mass., and working at Computer Corp. of America as a senior systems analyst. . . . **Kim Lewis**, married in February 1989, lives in Redondo Beach and works at the Aerospace Corp. She got her master's from Stanford in 1986. . . . **Chip Palmer** got married in the spring of 1989 and acquired a house in the bargain. He's working as a patent liaison at Du Pont, which is "a lot different than the chemistry lab I've gotten used to." . . . **Alice Hoffman** married Bill Doyle last July and had a great time honeymooning in the South Pacific. She has started her own development company and has bought an apartment building for conversion into coops.

Ken Snow and I (**Stephanie Pollack**) married last October; classmates in attendance included **Rick Cohen**, **Mindy Garber**, **Richard Epstein**, **Alison Kutchins**, **Mitch Rosenberg**, and **Linda Schaffir**. . . . Last November, **Scott Hyman** married Phoebe Swadlow, an information systems consultant at Ernst and Young. Scott finished a PhD in physics in December and is now doing a postdoc at the National Institutes of Health in artificial neural network research. . . . **Doug Finch** will join the ranks of the married in August when he weds **Stephanie Clark** of Coronado, Calif. Doug is at Harvard Business School after a two-year stint in Las Vegas as the general manager of a start-up manufacturer of graphite composites located on the Paiute Indian Reservation.

Now for children. . . . **Vincent Rojo** sends his regards from New Hampshire, where he lives with his wife Heather and 2-year-old daughter, Catalina. He is a business development manager

at Sanders Associates, a Lockheed company. . . . **Cynthia Hale Nicholson** remarried last year and is happily helping to raise three young stepchildren. Cynthia is in her sixth year at General Dynamics Land Systems.

It's graduation time for other classmates. . . . **Judy Badner** graduated from medical school in May and is doing a residency in psychiatry at McLean Hospital in Belmont, Mass. . . . **Thomas Piccone** received his ScD in metallurgy from MIT in February and is doing a postdoc at the Institute.

California, here they come. . . . **Pat Houghton** reports that he saw several classmates last year while they were visiting the Palo Alto area, including **Lucinda Linde**, **Elena Rozier**, **Mike Dominian** and **Tom Popik** (now a management consultant). . . . **Eric Bier** writes that **Anne Morone** and **Steve Ladd**, '81, threw an innovative party last year, borrowing a friend's house in California and inviting friends, including **Eric** and **Karen Perizzolo**, to fly in for a "jet set" party. . . .

Hajime Sono is still at the Jet Propulsion Laboratory, Caltech, now as an image analyst and programmer for the Magellan project to radar map the surface of Venus. He is the player/coach of the Caltech hockey team and a skater/coach for the Southern California Speed Skating Association.

Allan Bruckshanks and his wife, Linda, left California to move back to Austin, Tex., last year. He is now the plant manager for Rolm, which manufactures telephones. . . . **Capt. Pete Rogers** of the Air Force is enjoying his work on Florida's Space Coast. He is a propulsion engineer at Cape Canaveral and a member of the Delta II launch team that is assembling the constellation of 21 NAVSTAR Global Positioning System satellites.

News from the Massachusetts contingent. . . . **Josephine Lee** has been an assistant professor of English language and literature at Smith College in Northampton, Mass., since last September. She had been an assistant professor at California State University at Northridge since receiving a PhD in English from Princeton in 1987. . . . **Brian Brenner** is a civil/structural engineer and computer expert in Parsons Brinckerhoff's Central Artery project in Boston and the recipient of the company's 1990 William Barclay Parsons Fellowship for his proposal to develop an automated analysis and design software system for cut-and-cover tunnels. . . . **Whay Lee** claims he's been an honorary resident of Ashdown House since graduation. He's working at Codex Corp. in Canton doing research on voice/data integrated communications networks. . . . I recently ran into **Steve Schwartz**, who is living in Brookline and working at DEC.

If you want to see more nice, long columns, write to East Coast correspondent **Linda Schaffir** (50 Aiken Street #512, Norwalk, CT 06851), West Coast correspondent **Michelle Gabriel** (656 S. Fair Oaks Ave., D-211, Sunnyvale, CA 44086) or me.—**Stephanie Pollack**, secretary, 135 Sutherland Rd., Brighton, MA 02146

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Question: Identify the mystery person who wrote, "I'm on the faculty of the business school at Duke University, where I teach mostly statistics. Living in Durham has confirmed my belief that there's no place like Boston. But at least it's warm here." Answer: I don't know. The mystery person sent his/her comments along with a donation to MIT but forgot to write down his/her name. Oh well, thanks for the money!

We did get additional news from classmates who wrote their names. **Walter Daniel** is living in Annapolis, Md., and is assistant professor of aerospace engineering at the United States Naval Academy. . . . **Will Equitz** recently graduated from Stanford University with a PhD in electrical engineering. Will is now working at the IBM Almaden Research Center in San Jose, Calif. . . . **James "Keg" Miller** lives in Lexington Park,

Md., where he is in the Naval Test Pilot School. He will finish in June 1990, when he will go to work for the Naval Air Test Center at Patuxent River, Md., working with the "new" technology airplanes and equipment. . . . **Chester Barry** and his wife, Edith, are living in Arlington, Va., "enjoying the cultural offerings and international cuisine." Chet left Du Pont to work as a patent examiner for the U.S. Government. He will be attending law school in the fall. . . . **Harry Newman** writes that he is currently the playwright-in-residence at the Cincinnati Playhouse in the Park, and will be there through August 1990. . . . **James Kirk** writes that he finished his MBA at Boston University and has moved to Salem, Mass. James will be working for Genzyme in Cambridge.

In this month's You-Heard-It-Here-First category, **Kristin (Kinta) Foss** and Palmer Sodderberg have announced their engagement. Kinta met Palmer at Raychem, and they have been dating for several years. Congratulations!

In the Promotions Department: **Ruy Cardoso** has been promoted to senior consultant, Actuarial, Benefits, and Compensation Group, at Coopers & Lybrand in Boston. . . . **Mike Santullo** has been promoted to director of software development at Raynet in Menlo Park.

Please note the address change below, as I will be on the move for the next few months. I certainly would not want to inhibit the plethora of mail I have been receiving.—**Jonathan Goldstein**, secretary, TA Associates, 45 Milk St., Boston, MA 02109

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Craig Reynolds has been named a fellow of the Society of Actuaries. Craig is working in Seattle for Milliman and Robertson. . . . **Christopher Kennedy** has joined the Suffolk Construction Co. as project manager. Previously, he had managed a branch of the Aberthaw Construction Co. in Stamford, Conn., and now he has made the move back to Boston. . . . **Larry Deschaine Jr.** is giving something back to his community and has volunteered to do some underground fuel tank safety testing for the Plymouth fire station. Larry no longer actually lives in Plymouth, but he is a former volunteer in the fire department.

Carol (Webb), '87, and **Bill Mohr** welcomed Margaret Lloyd Mohr into the world last November. Bill got his PhD in materials science from Stanford and now works for Shell Westhollow Research Center in Houston. Bill still finds time for his old IAP hobby, the St. Valentine's Day Massacre map race.

Most of the news is coming from the cards you send in with your Alumni Fund gifts. It is great that so many of you are giving (so that you continue to receive the *Review* and this column), but please do not forget to put your names on the cards. Keep it up, and also send me a letter now and again. . . . **Heni Meerman** is pursuing a PhD in chemical engineering at the University of Texas at Austin and is also a successful age group triathlete in his spare time. **Kenneth Freedman**, M.D., just graduated from Tel Aviv University Medical School and is now in internal medicine at Albany Medical College.

Alyssa Goodman is now a president's fellow (postdoc) at UC/Berkeley in the Department of Astronomy. She finished a PhD in physics at Harvard in September. . . . **Stephen Baker** was named an associate at the architectural office of Woo and Williams in Cambridge, joining another MIT alum, Dennis Carlbert, MAR '84. . . . **Betsy Hanson** completed a master's in the Science and Environmental Reporting program at NYU in December. An anonymous classmate (no name on card) was married in June to Margaret May. The couple met at Spectra-Physics in Eugene, Ore. Please name that alum!

Mark Radlauer is packing it up and moving to Colorado this July. He is looking forward to an outdoor-oriented life, once a beaver. . . . **Philip**

Gleckman set the world record for highest solar concentration (I can only guess?), as a physics PhD student at the U. of Chicago. He is currently the leader of Optical Technologies at Nioptics Corp., a U. of Chicago startup.

Jim Addison is still at Stanford getting a PhD in electrical engineering. His wife, Jennifer, has joined him in the grad school life at Stanford, starting on her MBA. Another anonymous card, from someone who served as the New York state finance director for the Duke's campaign and is now working in the New York mayor's office as assistant to the deputy mayor for finance and economic development. Whoever this is, my parents are counting on you to whip the city into shape. . . . Looks like **Daphne Kamely** recently completed a PhD and is now scientific advisor for biotechnology for the Army, in Aberdeen, Md.

Phillip Tietbohl is pursuing a PhD in clinical psychology at the University of Virginia. (Notice how people pursue PhDs, not just work on them?) He enjoys the peace and beauty of the mountains and is more at home with his new major—the working of our minds. . . . **Salvador Acosta** married Anina Ruiz-Giusti on December 23, 1989. . . . **Francisco Vega** was the best man and Hector Picon, '78, was also in attendance. They are living in Aguadilla, P.R., where Salvador has been working for Hewlett-Packard for over three years. . . . **John Ying** graduated from Wharton with a dual MBA and MA. He is currently in New York working as an associate in investment banking with Merrill Lynch.

That is all for now. Am I employed yet? From Boston, **Howard Reubenstein**, secretary, 38 Belknap St., Somerville, MA 02144 (617) 625-9299, hbr@ai.mit.edu

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Kathy Geary Balles confirms that she and Eric, '80, are indeed the proud parents of a son, Daniel Peter. He was born last November 28 and weighed in at 9 lbs., 8 oz. . . . **Dave Douglas** is engaged to Pam Gannon, '84, with the wedding set for this September. . . . Speaking of Lambda Chis, Dave's fraternity brother, **Tom St. Louis** purchased a house (depleting his life's savings) in Groton, Conn. He mentions something about his nearest neighbors being chickens and goats!

Danielle Sherwood has finished her last term at Harvard B School. She plans on returning to Goldman Sachs in New York City. . . . **Alysa-Ann Kodisch** has taken a position with Shearson-Lehman as a stockbroker, so if anyone wants to dabble in the market, give her a call in New York. . . . **Chris Woelfel** plans to return from Japan via Turkey to make it to our 5th reunion, where she hopes to run into plenty of classmates.

Brian Morgan is a second-year law student at UC/Berkeley. Brian will be returning to Wall Street to work for a law firm there. Before attending law school he worked in investment banking. This summer he plans on spending some time in Dallas and/or Honolulu. . . . **Linda Sheehan** is also at UC/Berkeley. She is in the third year of a joint master's in public policy/JD program. She and her husband, Roger, live in the South Bay.

Elizabeth Raphael is halfway through her first year as an emergency medicine resident at Detroit Receiving Hospital. She just bought a house in the suburbs. . . . **Robert Malchman** graduated from U. of Michigan Law School in May 1989 and is serving a one-year clerkship in Cincinnati with Judge David A. Nelson of the U.S. Court of Appeals for the Sixth Circuit. . . . **Edward Podszus** is a student in U. of Michigan's Law School. He says, "Yes, there are many things to do with an engineering degree, even after you've practiced it awhile!"

Charles Lane has decided to stay in San Diego and forego getting a PhD at MIT because his job at Duralcan USA is going so well. He'll be earning an MBA at San Diego State University to advance his climb up Ancan's corporate ladder. Besides, how could he leave a company that

sends him to Toronto, London, and Venice on business? If anyone is interested in cost-effective ceramic reinforced aluminum, give Charles a call. Likewise for anyone with good scuba diving connections!

Peter Quigley founded Fiberstar, Inc. in June 1986. He is in the business of designing and manufacturing advanced composite materials. His company is located in Wareham, Mass., and employs 18 people. Their 1989 sales were \$750,000, and projected 1990 sales for carbon fiber tubing are \$1.8 million. . . . **Andy Weiss** is starting his own business called Comfortable Concepts Corp. to manufacture disposable medical supplies.

James Leu is working for the State Street Bank and Trust Co. in Boston. He was promoted from investment officer to assistant vice-president. . . . **Roberto Engels** is working for a textile company in Brazil (Santista) as a product manager. . . . **Thomas Boucher** is now at the naval station in Rota, Spain. He is married to Julie Dugan of Dudley, Mass.

Yes, I am still working at Apple. My title is Silicon sorceress, and I'm in the graphics hardware group within the R&D department. By the time this goes to print, my husband, **Jeff Winner**, swears he will no longer be working for Oracle. On the home front, our three dogs and we survived remodeling our house. In order to finish (nine months for a two-month job!), we got some "hands-on" experience with construction. Consequently, we will be seeing our contractor in municipal court.—**Stephanie Winner**, secretary, 1026 Live Oak Dr., Santa Clara, CA 95051, internet: winner@apple.com

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John Swartz sends a letter outlining his life since graduation. He worked for RCA/Automated Systems in Burlington, Mass., for a little over two years, living in a studio apartment about twice the size of his dorm room at East Campus. During the spring/summer of 1988, RCA (which is now GE) began laying people off, so John went to work for MITRE Corp. (he got out before they got to him) doing systems analysis on a communications system for the Air Force. According to John, MITRE doesn't stand for anything, but the standing joke is it stands for MIT Reject Engineers. John will be married this September 15 to Carol Strong, an RPI grad, and they will spend their honeymoon in Hawaii. John has also been taking karate lessons at Fred Villari's Studios of Self-Defense and received his black belt last year. Since then, he has become co-owner and instructor of a Fred Villari Studio in Malden, Mass.

Don Davidoff was also nice enough to drop me some news. Don is getting out of the Air Force in April (so by the time this goes to print he should be long gone) and heading back to Washington, D.C. . . . **Karl Tucker** and Login Kapitan, '85, are still at Ballistic Systems Division at Norton AFB, Calif. Don was working with Bruce Lundie, '88, who pretty much took over Don's job when he left. . . . **Greg Greeley** is still at the Pentagon and seems to enjoy it.

Peter Tatron is still in the Washington, D.C., area working for a world hunger research group. He recently came back from a year in Africa. Don attended a party on St. Patrick's Day in Boston and ran into **Pam Sullivan** and **Steve Huntley**. Pam is working on Shuttle experiments for astronauts and had the pleasure of taking three flights in the NASA zero G simulator (and experiencing reverse peristaltic waves each time). Pam is trying to get a job at the Air Force Academy teaching philosophy. Steve recently got out of the Air Force and is taking it easy for a while.

Harish Sangani is still enjoying working at Enichem Americas (now Enimont Americas) and hoping to start working towards a PhD in chemical engineering at Stevens Institute of Technology in January 1990. . . . **John Rulnick** visited Berkeley and saw **Ben Costello**, **Chuck Laumon**, and

Paul Hermann, Andrei Konradi, '87, and Jeff Heglie, '85. He also visited LA and saw **Greg Harrison**, Ray Covert, and Dave Glassner, '88, in September 1989. He learned a lot about "political correctness" and "SDI parking." Greg has been working on stand-up comedy and will be performing at LA Cabaret in Encino, Calif., in late April.

Hisashi Fujinake has moved into his own rabbit hutch by a military base in Japan. There are gangsters getting into fights every night at the Karaoke bar on the first floor. He is paid about \$22,000 a year, and that's because he works overtime about 30-40 hrs each month. He's not sure he qualifies for the designation of "yuppie." . . . **Scott Musinski** is in his third year of med school at University of Connecticut. . . . **Alexandra Klikoff** is still in med school, finishing up her second year at UC/Davis and overwhelmed with family responsibilities, that is, her 3-year-old son, Michael.

John Martin got married in Vail, Colo., last summer and moved back to the San Francisco area in November. He is still with Oracle as a senior consultant. He's applying to Stanford Business School for this fall. . . . **John Bartholomew** is getting married to Kimberly Foss (Emmanuel, '90) in July 1990 and honeymooning in Great Britain. His work at Mentor Graphics Corp. is going well: he often runs into Rich Seiter, '87, and Robert Leong, '83. John is still playing bass in various bands in the Portland area. . . . **Mike Straub** paid him an enjoyable visit at Thanksgiving. On a quick trip to Boston in December, John saw over a dozen friends and alums, with special thanks to Eric Ostling, '88, and Gary Leskowitz, '88, for the gathering at their pad.

Susan Vissar is a PhD candidate at University of Wisconsin-Madison in chemical engineering. She has written a textbook chapter, "An introduction to Polymers and polymeric biomaterials," in *Biomaterials Science: An Introductory Text*. She has also presented several papers at conferences all across the U.S. . . . **Sonya (Sakai) Vogtmann** is buying a townhouse with her husband in Hawthorne, Calif. I ran into Sonya in Las Vegas at a volleyball tournament. She is also taking ballet lessons while acting as the marketing director for the dance studio, Gotta Dance. . . . **Dave Martin** is getting married in June to a girl he met at Oracle, where they both work. . . . I hear that **Tom Paterson** is working for GTE in the Palo Alto area. . . . Thanks for the news!—**Mary C. Engebretsen**, secretary, 1800 Hermosa Ave., No. A, Hermosa Beach, CA 90254

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And the saga continues. . . . **Alan Gordon** has changed jobs in July and is now working at Interactive Images in Woburn, Mass. . . . **Michele Kinguel** is living in Arlington, Mass., and is presently working at Camp Dresser & McKee, Inc. . . . **Alexander Chow** writes from Gainesville, Fla., to say he became engaged to Theresa Chan, a Boston University graduate student in the College of Physical Therapy. Imagine, meeting in Florida after living across the Charles from each other for four years. The wedding is planned for the summer of '91.

Paulette Struckman is living in Seattle, Wash. She has completed a master's in physics at the University of Alaska, Fairbanks, and is currently pursuing a PhD in oceanography at the University of Washington. . . . **Phyllis Kristal** is also studying at the University of Washington. She is working on a master's in mechanical engineering.

I received one bit of information with no signature. Can you identify this person: a class member who graduated in electrical engineering and went on to get his/her master's degree from UC/Berkeley, graduating in June 1989. He/she is currently working at Oracle Corp. in Belmont, Calif. The final clue—he/she intends to go back and finish a PhD within the next few years. (Editors note: Please be sure to sign your name on all

MIT contribution slips, so we can identify your news for the Review.)

Bridget Fitzpatrick writes from Texas: "I left Michigan State—just got tired of graduate school. It was going to be another year or two for a master's and I couldn't see staying that long, at least not while retaining my sanity! There are so few grad students in chemical engineering that once they have you they don't want to let you go! At any rate, I'm working as a process engineer for Hoechst Celanese Corp. at their Bishop, Tex., plant. It's an interesting plant for an engineer—we make chemicals, plastics, and pharmaceuticals. Bishop is about 30 miles from Corpus Christi. I've been enjoying a warm winter here in the coastal bend of Texas. . . . **Karen Bardeer** is doing her student teaching now; she plans to teach high school chemistry and is working on a master's in education."

Lastly, a report on a recent party in the Boston area. **Bob Vokes** was in town to celebrate his birthday with some of his old buddies. Bob is now working in Copenhagen for McKinsey, Inc. Members of our class—**Jordan Levin**, **Jon Kramarsky**, and **Mintoo Bhandari**—were all at the party.

Gene Cohen, **Stan Oda**, **Janet Zahradnik**, **George Cathey**, **Lowell Kim**, **Anthony Scotti**, and **Dan Kennedy** are all watching the NCAA Finals in the other room and making far too much noise. I'll have to sign off for now so I don't miss all the fun. Please write me a letter—everyone is dying to hear from you!—**Stephanie Levin**, secretary, 41 Prentiss St., Cambridge, MA 02140, (617) 547-6673 or dkennedy@oracle.com

88

How is everyone's summer going? Remember, too much sun . . . MELANOMA! (Sorry, you can see med school is getting to me.) On to the news. . . . **Lisa Vingerhoet** and **Gene Tung** are going to be married this summer in Acton, Mass. They are both pursuing PhDs at UC/Berkeley. . . . **Kimberly Thompson** and **Kamran Badizadegan** are going to be married in December in Phoenix, Ariz. Kim is working as a consultant in Cambridge, Mass., for David Burmaster, '67, at Alceon Corp. . . . **Michael Gaidis** will be married to Denise Jodoin (of Simmons) in October. Mike is currently attending Yale, pursuing a doctorate in applied physics. He sends a "hello" to all the Deltas, and "good luck to Walter Alessi and the lacrosse team this year." Looks like marriage season! Congrats to all of you!

Liana Giorgi is finishing her PhD at Cambridge this year. She is also engaged. . . . **Al Tadros** finished a master's at MIT in February and moved to California to work for Ford Aerospace. . . . **Edye Udell** is now working for Jacobs Engineering in California. . . . **Sean Beausoleil** got married after graduation and moved to Atlanta, Ga., to work for the Winter Construction Co. as an office engineer. "No real engineering, mostly project management. Life is good even in the 'real world'." . . . **Richard Duncan** worked at Textson Lycoming (Conn.) for one year, then started work at GE in Evandale, Ohio, in August 1989. He works in military turbine aero and cooling design on the ATF Contract.

Michelle Pessoa is currently working for the Electronic Publishing Center in New York City. She does computer graphics for elementary school textbooks using Macs. She is also pursuing a master's in package design at Pratt Institute. Michelle sends her greetings to "all her friends in Chocolate City." . . . **Andrew Miklich** is a graduate student in physics at UC/Berkeley. His work concerns making electrical devices out of the new high-temperature superconductors. . . . **Adam Schwartz** is currently working towards a PhD in non-linear control theory at UC/Berkeley. . . . **Devin Knopf**, **David Suh**, and **Pauline Perez** are all doing fine as second-year medical students at UCSF.

Vikram Chaudhary wants us to know that

"having worked at the shamelessly capitalist corridors of Oracle Corp. in San Francisco," he is now taking a vacation abroad. He will visit Paris, Amsterdam, and New Delhi. "Then it's back to Relational Database software development for purposes I am yet to fully understand." Let's hear from more of you soon!—**Grace Ma**, secretary, 1199 Bonneville Dr., Salt Lake City, UT 84108

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I'd like to congratulate all of our classmates who graduated this year. As a reminder, the alumni office will consider current graduates to be members of the class of 1990 unless requested to be class of 1989. So, those who would like to receive information about class of 1989 activities (including reunions), please inform the alumni office.

The mailbox wasn't very full at all this month, so please write! (If you don't want to write about yourself, let me know what friends are doing!)

Rich Berg writes from Pittsburgh, where he is attending Bettis Reactor Engineering School. He's been sent there from his job in Washington, D.C., where his group at Naval Reactor Headquarters oversees research done for nuclear submarines. In August, after a five month cram NukeE MS equivalent, he'll be returning to DC. Meanwhile, Rich has become an avant-garde music fan and has seen Laurie Anderson in concert.

Jason Nieh is at Stanford, where he is doing research on optimizing compilers for multiprocessors. In June, Jason will be receiving his MS, and will probably spend the summer on research for his PhD. . . . **Anthony Lombardo** is attending the University of Alabama School of Medicine on an MD/PhD scholarship. . . . **Frank Jones** and **Paul Monaghan** have completed the Basic Surface Warfare Officer's Course at the Naval Education Training Center in Newport, R.I., where **Margaret Moore** also graduated from Basic Civil Engineer Corps Officer Course and **Matthew Junker** completed Officer Candidate School.

Another classmate in the Harvard-MIT joint medical program is **Elaine Tseng**. She's been taking classes at MIT this term. After graduating last February, Elaine did a lot of travelling, tracing Homer's Odyssey through Athens, Corinth, Mycenae, Epidaurus, and other locations in Greece, Turkey, and Egypt. Following all that was a trip to Taiwan and Hong Kong with her family. Unfortunately, the episode in China, which erupted the day before our commencement exercises, precluded them from visiting the mainland.

The rest of the news for this article comes from **Charles Whetsel**, who is working at JPL. During the President's Day weekend, Charles and **Karen Koyama** who is working at TRW in Redondo Beach, played host to the "Aero/Astros from the east side of campus on the west side of the continent." . . . **Mike Fincke** and **Cristina Vilella** drove down from northern California, where they are currently living. Mike is studying furiously to finish an MS at Stanford before beginning his active duty in the Air Force in the spring. Cristina is stationed at Castle AFB in Merced and is responsible for the maintenance of 20 KC-135 aircraft and "several scores of cute airmen."

Christian Alcalá battled snowed-in airports across the country to fly all the way from Cornell for his parent's anniversary and the mini-reunion. Christian has been digging in for his PhD quest. The gang, joined by **Roman Hachkowski**, saw several LA sites and attempted to hook up with **Robert Newkirk**, who is stationed at LA AFB in El Segundo, but were unsuccessful.

Charles reports that other Aero/Astros seen in the southern California area include **Alan DiCicco** and **Cassi Lawrence** (both at JPL), **Jim Reich** and **Kia Freeman** (at General Dynamics in San Diego), and **Jean Kim** at Hughes in LA.

Thanks to all those who wrote this month (especially Charles), and I hope to hear from all of you soon!—**Henry Houh**, secretary, 5380 Hollow Dr., Bloomfield Hills, MI 48013. e-mail: ripleh@athena.mit.edu



COURSE NEWS

I CIVIL ENGINEERING

Kenneth R. Maser, PhD '71, writes: "I have been busy with my firm, Infrasense, Inc., a small engineering firm specializing in the evaluation of materials and structures. We use ground penetrating radar and other NDT technologies to evaluate the conditions of asphalt-covered bridge decks and pavements. Though based in Cambridge, our work is international." . . . **Peter D. Hall**, PhD '80, heads a consulting practice based in Washington, D.C., and Orlando, Fla. . . . **Neil S. Shifrin**, PhD '80, reports: "We are celebrating the fifth anniversary of our Gradient Corp., founded in March 1985. It is located on Brattle Street in Cambridge. We have 40 employees plus a regional office in Boulder, Colo. Roberta and I have a daughter, Lily, born November 9, 1988." . . . A note from **Joseph Burns**, SM '81, in Chicago: "I am associate director and head of the Structural Engineering Department for the London office of Skidmore, Owings, and Merrill. Building projects include Canary Wharf and the renovation of County Hall." . . . Two notes from Canadian alums: **Guy Dufresne**, SM '65, is president and CEO at Kruger, Inc., in Montreal, Quebec, and **Samuel Davis**, SM '39, has received an honorary LL.D. from the University of New Brunswick. He was re-elected city councillor of St. John for a 7th three-year term and he has served as mayor and deputy mayor. . . . **Jane A. Seiden**, SM '88, is a project manager with Equity Ventures, Inc., in Warwick, R.I. . . . **Thomas N. Harvey**, PhD '72, is manager of the Transportation Division at HMM Associates in Concord, Mass. He was director of the Office of Research & Analysis for the U.S. Department of Transportation. . . . One of the six 1989 recipients of Armo Research & Technology Technical Achievement Awards is **David M. Kundrat**, ScD '80, senior staff engineer residing in Cincinnati, Ohio. He was recognized for development of a model which allowed predictions of variable blast furnace operations.

Maimonides School of Brookline, Mass., recently honored **Norman Kram**, SM '73, with a Pillar of Maimonides award. Kram, president of Barkan Construction Co. in Chestnut Hill, Mass., worked as a volunteer supervisor of the construction of four new classrooms on the Maimonides campus over the past two years. Kram, who is a member of the school's board of directors, and his wife Deborah have three children enrolled at the school. . . . A *Boston Globe* feature on "Looking to the Millennium" quoted MIT Professor **Joseph M. Sussman**, PhD '68: "Congestion and the waste it produces are major public policy issues for the 1990s. We must figure out ways of getting the American citizen out of his/her car into mass transportation." . . . MIT Professor **Peter S. Eagleson**, ScD '56, delivered the Robert E. Horton Memorial Lecture, entitled "Global Change—A Catalyst for the Development of Hydrologic Science," at the 70th Annual Meeting of the American Meteorological Society last February. . . . MIT Professor **Rafael L. Bras**, '72, has been busy. He was named associate director of MIT's new Center for Global Change Science and also

named to the National Research Council's Board of Atmospheric Science and Climate. In addition, Bras also delivered a talk on climate change and agriculture at the Food and Agro Meeting during the World Economic Forum in Davos, Switzerland, last February.

The Alumni/ae Association has received word that **Andrew W. Dawson**, CE '72, of Belvedere, Calif., died on January 9, 1990. No further information was provided.

II MECHANICAL ENGINEERING

Chester L. Nachtigal, PhD '69, sends us word from Seattle, Wash.: "I am the editor and a contributing author of *Instrumentation and Control: Fundamentals and Applications*, scheduled to be published in May 1990 by John Wiley & Sons. Forty-five authors contributed to this handbook, 32 from industry and 13 from universities. MIT alumni who contributed are: **Adam Bell**, ScD '69, **David Hullender**, PhD '70, T. Peter Neal, '62 (XVI), **Karl Reid**, ScD '64, and **David Wormley**, '62." . . . **Ian C. Faye**, SM '86, is living in West Berlin. He is currently on contract to the Technical University of Berlin working in industrial robotics research for a European community project. Prior to 1989, he was on a two-year contract with DFVLR in Weßling, Bavaria. . . . **Ralph G. Colello**, SM '66, has been promoted to VP and managing director of Arthur D. Little's Operations Management Section.

Joseph C. Batty, ScD '69, is a professor of mechanical engineering and senior scientist for the Space Dynamics Lab at Utah State University. . . . **Neil Doherty**, SM '88, writes: "I'm living in Portsmouth, N.H., and working in the Research Department at Harris Graphics Corp., which manufactures printing processes." . . . **Leonard Solomon**, SM '69, has just completed 18 years of service at Harvard University and is currently director of laboratories for the Department of Earth and Planetary Sciences. He also co-manages Harvard's "Atmospheric Research Project," a research group dedicated to the study of ozone depletion in the stratosphere. . . . A note from **Sidney A. Whitt**, SM '34: "Old classmates of '34, Course II, coming through Bozeman, Mont., to Yellowstone or Glacier National Parks would be welcome to a venison or antelope-chops lunch or dinner. I am 81 now, retired from SUNY, but keep at it. I chair two engineering scholarship committees at the Montana State University. Of late, somehow, I got elected to the New York Academy of Sciences."

Jose Maldifassi Pohlhammer, SM '83, is pursuing a PhD in management of technology at Rensselaer Polytechnic Institute. . . . **Hjalmar D. Bruhn**, SM '37, professor emeritus (Agricultural Engineering, University of Wisconsin) attended the 11th International Congress on Agricultural Engineering held at Trinity College, Dublin, Ireland, last September. He presented a paper on the impact of transportation on forage harvesting and processing procedures. In October he attended the third International Conference on Leaf

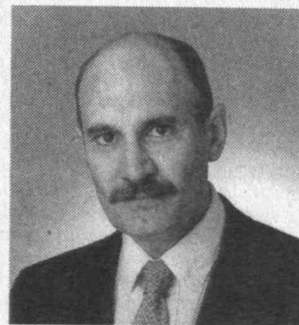
Protein Research held in Italy. He gave one paper on drying plant protein concentrate and a second on sanitation in processing of protein. He was co-author, with four others from various countries, in preparing a glossary on green plant protein extraction.

Robert G. Foster, SM '63, is now the chief executive of Commonwealth Bioventures, Inc., in Worcester, Mass. . . . Navy Lieutenant **Michael B. Stanton**, SM '89, is a recent graduate of the Navy's Engineering Duty Officer School. During the six-week course, Stanton received instruction in the plans, programs, policies, and procedures by which the Navy accomplishes the lifecycle of Navy ships and systems. He also studied Navy R&D, acquisition, and maintenance. . . . **Kenneth R. Diller**, ScD '72, professor of biomedical and mechanical engineering at the University of Texas at Austin, has been named a Fellow of the American Society of Mechanical Engineers (ASME).

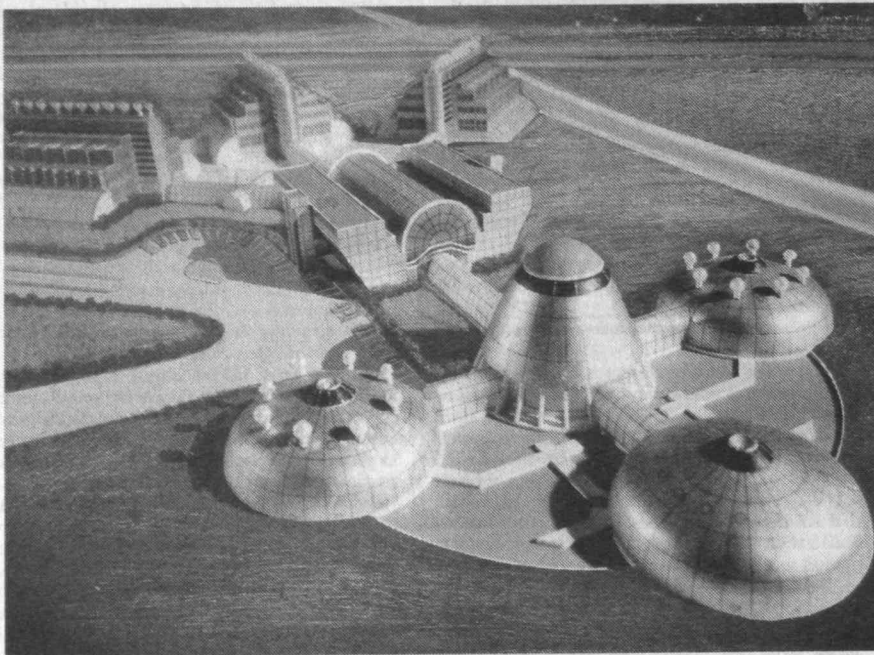
The Alumni/ae Association has been notified that Colonel **Asher B. Robbins, Jr.**, SM '40, of Alexandria, Va., died on January 11, 1990. No further details were provided.

III MATERIALS SCIENCE AND ENGINEERING

Anil R. Chaudhry, SM '83, sends a note from Jupiter, Fla.: "I have now finished three rewarding years with Pratt & Whitney's Materials Engineering Lab working with the advanced coatings group. I was recently honored with an Eagle Award for developing an improved seal coating for jet turbine engines. Life in southern Florida has been wonderful, especially when the weather map shows sub-zero temps. up north! I play tennis and enjoy my 5-month-old son, Akash. While working full-time at P&W, I've been able to squeeze some time to do my second masters in engineering management which I plan to have finished by April 1990. . . . **Joan S. Adams**, SM '80, writes: "I am consulting for high-tech French companies seeking to sell, license, etc., their technologies in the U.S." . . . **Rodney E. Hanneman**, PhD '64, is currently VP of Reynolds Metals Co. in Richmond, Va., serving as their chief technical officer. He also serves on the boards or advisory bodies of several profes-



D. Apelian



Curtis Charles, SM '89, is proposing that Trinidad overcome problems in its agricultural and fishing industries by building combined hydroponic agriculture and aquaculture facilities that utilize natural light. The Washington, D.C.-based architect is preparing a formal presentation of ideas based on his master's thesis for the government of Trinidad. He is optimistic that the Inter-American Development Bank, which already aids Trinidad's farmers, would help develop such facilities. The technology embodied in his design (in drawing at left) is applicable in other equatorial countries, and Charles is convinced that such technology must be considered seriously by a world faced with severe climate change.

sional societies, universities, and the Science Museum of Virginia Foundation. Hauneman is a member of the strategy guidance committees of Reynolds Metals Co. and Reynolds International, Inc.

John S. Benjamin, '61, writes: "Since leaving INCO in 1984 after 19 years, I have been a bit of a metallurgical gypsy. I spent two years with Cabot Stellite, one year with Stoodly Deloro Stellite (after an external LBO), and one year with GAF (who announced an internal LBO one month after I arrived). I am now at the Alcoa Technical Center as director of advanced alloys and processing with responsibility for a group of about 200. It is both challenging and enjoyable. As the Alcoa liaison person for MIT, I get the chance to visit the campus every few months."

Diran Apelian, ScD '73, associate VP for academic affairs and graduate studies and Howmet Professor of Materials Engineering at Drexel University in Philadelphia, has been named provost and VP for academic affairs at Worcester Polytechnic Institute (WPI) in Worcester, Mass. Apelian will assume his new position as WPI's chief academic officer on July 1, 1990. He has been honored with many awards and is a renowned author in his engineering field with more than 170 technical publications and several books to his credit. In his present position at Drexel, Apelian is establishing a new course on the history of ideas that have shaped technology. "I've been a teacher, researcher, and administrator and am looking forward to the opportunities at WPI. I want to be involved in the management of the Institute, of course, but I also want to give an occasional seminar to maintain contact with the classroom experience and keep current in my research and scholarship," says Apelian in a WPI press release.

IV ARCHITECTURE

According to her biosketch, **Idit Harel, PhD '88**, is "currently interested in the development of multimedia software design and production tools for young children, and established the FutureLogo Discussion Group which investigates the development of the next-generation unified programming or software environment for young

learners. Last September she was invited to become a member of 'Friend21,' a Japanese organization for developing the next generation of personalized information environment, and to give two talks during their first International Symposium in Tokyo. Harel found it quite astonishing to be the only woman researcher in this symposium of 400 people, and especially to be the only one focusing on learning technologies and children's cognition in relation to interface design. Most recently, Harel edited the Epistemology and Learning Group's fifth anniversary collection of papers entitled *Constructionist Learning*, which includes project reports, research in progress, and essays by the members of her group." . . . **Elizabeth G. Camargo, SM '85**, is engaged in architectural and planning projects at Johnson, Fain & Pereira Associates, Los Angeles, as a senior technical architect.

Barnett B. Berliner, MAR '52, sends us a list of his latest activities. He is a retired chair of the board for Hospitality International, Inc. In 1990 he completed two years as president of Faneuil Hall Marketplace Merchants Association, Inc. He is the founding director of Brookline's Arts Center and for the past six years has been on the Brookline Preservation Commission. He is president of B.B. Berliner, A.I.A. Associates, Inc., and president of Lincoln National, Inc. . . . **Alex L. Seid, MAR '74**, writes: "Have pilot's license, will travel. Working on second airport project for Mass." . . . **Robert L. Ziegelman, MAR '59**, sends word from Birmingham, Mich.: "I was elected chair of the board for Luckenbach/Ziegelman and Partners, Inc., Architects. New projects include: Kellogg Foundation's new world headquarters and Domino Farms condominium (130) townhouses in association with Charles Moore." . . . **Don Lewis, MAR '73**, is practicing at Lewis & Malm Architecture in Bucksport, Maine. The firm has designed 14 schools and 3 nursing homes and was the recent winner of a Maine AIA Design Award. Lewis lives in Bangor, Maine.

Steven Imrich, MAR '80, has been named an associate at Cambridge Seven Associates, Inc. Imrich joined the firm in 1984 with a diverse background in design and construction. Since then he has acted as a project architect on a number of the Cambridge Seven's aquarium, museum, exhibit, and public transportation projects. . . . New York City's Kohn Pedersen Fox Associates

PC, one of the largest architecture firms in the United States, received the 1990 Architectural Firm Award from The American Institute of Architects (AIA). The award was presented at the Accent on Architecture awards gala held last February in Washington, D.C. It recognizes consistently produced "distinguished architecture" for the past 10 years. **William Pedersen, MAR '64**, design partner, is one of nine senior partners in the firm.

The Alumni/ae Association has been notified that **Eric A. Grubb, MCP '47**, of Chilliwack, British Columbia, Canada, died on July 6, 1989. There were no further details provided.

V CHEMISTRY

Robert Nelson, PhD '69, writes: "I am still an associate professor of chemistry at Georgia Southern University. I am doing collaborative research with NASA-Goddard Space Flight Center on cosmic dust analogs. I was re-elected last January as chair-elect of the Coastal Empire Section of the American Chemical Society." . . . **Allen H. Keough, PhD '56**, has been named a director of Vitronics Corp., in Newmarket, N.H. He continues as technical director of Metallized Products, Inc., in Winchester, Mass. . . . **James J. Burke, PhD '62**, has been promoted from fellow to senior fellow at Monsanto Co. in Saint Louis, Mo. . . . **Yongqin Chen, PhD '88**, currently a postdoctoral fellow at the University of Southern California, has won the American Chemical Society's Nobel Laureate Signature Award for Graduate Education in Chemistry along with his co-research supervisors, MIT professor **Robert W. Field** and former MIT professor **James L. Kinsey**, now at Rice University. Field and Kinsey, the ACS said, "have provided an enormously rich environment for catalyzing his [Chen's] development."

John B. Delos, PhD '70, professor of physics at the College of William & Mary, was selected as one of five winners of Virginia's 1990 Outstanding Scientist and Industrialist Awards. Delos was selected as the Outstanding Scientist and is known worldwide for his work in theoretical atomic and molecular physics. According to a William & Mary publication, "His most important

achievement has been to provide insight into the relationship between classical and quantum behavior of atomic systems. His most recent work on the highly excited states of hydrogen in strong magnetic and electric fields has had tremendous impact as researchers struggle to define more closely the area of quantum chaos or unpredictability. His careful and reliable work in this area has brought forth the order in the seemingly chaotic behavior of atoms. Selection of Outstanding Scientist is based on recent contributions to basic scientific research recognized as a definite advance of knowledge or as a significant technological development. The achievement should dramatize current progress in science in Virginia."

Two notices from Lehigh University in Bethlehem, Penn. regarding the American Chemical Society: **Albert C. Zettlemoyer**, PhD '41, distinguished professor emeritus of chemistry, received the first Distinguished Service Award from the Lehigh Valley section of the ACS. The award was presented for Zettlemoyer's dedication to chemistry and the ACS. He has been a member for more than 50 years and served as ACS president in 1981. **Donald M. Smyth**, PhD '54, the Paul B. Reinhold Professor of Material Science & Engineering, has been selected to become a Fellow of the ACS. Smyth specializes in the chemistry of electronic ceramics. He has co-written over 60 technical papers, holds 10 U.S. patents, and has received numerous research grants.

Paul L. Houston, PhD '73, has been elected a Fellow of the American Physical Society in the Division of Chemical Physics for "important contributions toward understanding molecular photodissociation dynamics, energy transfer, and gas-solid interactions; in particular, for his imaginative use of photofragment imaging and his development of the field of vector correlations." . . . **Stephen J. Weininger**, '61, professor of chemistry at Worcester Polytechnic Institute, has contributed a chapter entitled "Concept and Context in Contemporary Chemistry" to *Beyond the Two Cultures: Essays on Science, Technology, and Literature* (Iowa State University Press), edited by Joseph W. Slade and Judith Yaross Lee.

VI ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Two MITers—**Alan C. Shaw**, SM '88, a graduate student who has started his own educational-science company, and **Mark V. Scott**, a science librarian—were highlighted in a *Boston Globe* story on successful young blacks who are involving themselves in the problems of the inner city. Said Shaw: "We need to send out a call to the elite, the blacks who have gone off to college, to come back and live in those neighborhoods to be a role model for the children. The fact that we went to college is a part of this community's fruit. People in this community fought to get their children into the schools. And when the children don't come back, when they leave, there's something wrong there." . . . A *Boston Globe* feature on "Looking to the Millennium" quoted **Marvin Minsky**: "[Computers] are going to get rapidly faster because of parallel computers. In fact, some friends of mine are building a machine with a million processors."

One of the last published works of the late **Harold E. (Doc) Edgerton**, '27, was the foreword to the book, *Unfinished Voyages: A Chronology of Shipwrecks*, by John Perry Fish (Lower Cape Publishing Co.). In it, the reviewer reports, Edgerton "recounts his search for the Vineyard Lightship in 1968. It was one of the earliest attempts at locating sunken vessels, and he recalls the excitement when conventional sonar with a 90-degree rotating transmitter enabled them to 'see' the bottom and discover the wrecked ship." . . . **Thomas Huang**, PhD '63, professor in the Electrical and Computer Engineering Department at the University of Illinois at Urbana-Champaign, has been

New Germeshausen Professor Appointed

Robert S. Langer, ScD '74, has been named to the Germeshausen Professorship, previously held by Professor Emeritus Jay W. Forrester of the Sloan School.

The chair was established by **Kenneth J. Germeshausen**, '31, a founding partner of EG&G, Inc.

Langer is a biomedical engineer in the Department of Chemical Engineering, the Whitaker College of Health Sciences and Technology, and the Harvard-MIT Division of Health Sciences and Technology. He is widely known for developing innovative treatment-delivery systems, in particular controlled drug-release systems using both nondegradable and biodegradable polymers.

Langer's most recent work involves a biodegradable polymer carrier for the treatment of brain cancer now being tested in some 20 hospitals in the United States and Canada. The system allows surgeons to implant an anticancer-drug-carrying capsule directly in a patient's skull at the site of the surgically removed tumor. The drug is released at a precise rate to attack any tumor residue and poses fewer risks than intravenous chemotherapy.

Last year a patent based on Langer's research was named the outstanding patent of 1989 in Massachusetts and one of the 20 outstanding patents in the United States. Langer has been a member of the MIT faculty since 1978. □



selected as an associate in the Center for Advanced Study for 1990-91.

The National Academy of Sciences (NAS) has given its Award for Initiatives in Research (a \$15,000 prize established by AT&T Bell Labs in honor of William O. Baker) to MIT Associate Professor **James G. Fujimoto**, '79, for "contributions to femtosecond quantum electronics and applications of subpicosecond lasers to studies of electronic materials and biological tissues." The award is jointly shared with **Wayne H. Knox** of AT&T Bell Labs. It was established in 1980 and is awarded annually, in a different field each year,

"to recognize innovative young scientists and to encourage research likely to lead toward new capabilities for human benefit." . . . Mitre Corp. has elected **Barry M. Horowitz**, SM '53, to succeed **Charles Zrak** as president and CEO when Zrak retires in October, 1990. Horowitz has been on the board of trustees since 1989 and has been the executive VP and COO at the company since 1987. His responsibilities are the general management and direction of the company's overall technical, financial, and administrative activities. He has held several positions at Mitre since joining the company in 1969.

The National Technological University held a symposium in January 1990 entitled "High-Definition Television: Is America's Future on the Line?". The live satellite broadcast featured an all-star list of who's who in HDTV, including **Richard Wiley**, ScD '86, former chair of the Federal Communications Commission (FCC). . . . The National Academy of Engineering has elected two Course VI professors to membership in the Academy: **Michael L. Dertouzos**, PhD '64, also director of the Lab for Computer Science, was elected for "creative leadership in computer science, technology, and education"; and **Robert H. Kingston**, '47, adjunct professor, for "pioneering quantum electronic device research and its application to modern microwave and optical radar systems." . . . **Vernon Hughes**, EE '44, professor at Yale University, has been named recipient of the 1990 Tom W. Bonner Prize. The citation reads: "for his many contributions to the fundamental measurements of electroweak and strong interactions. We cite in particular his early recognition of the importance of high-energy polarized electron beams and his role in the measurement of the spin-dependent electroweak structure functions of the nucleon."

Jae S. Lim, '74, was promoted from associate professor to professor in Course VI, effective July 1989. Lim, whose research interests include digital signal processing and its applications to image and speech processing, joined the MIT faculty in 1978.

William F. Schreiber, EECS professor and director of the Advanced Television Research Program, was honored with two distinguished awards in 1989. In October, at the Technical Conference of the Society of Motion Picture and Television Engineers in Los Angeles, Schreiber received the 1989 Journal Award for his article entitled "Improvements to NTSC by Multidimensional Filtering." In addition, he recently received the Albert Rose Electronic Imager of the Year Award from the Institute for Graphic Communications. The Institute cited his contribution to the advancement of the technical state of the art in electronic imaging.

Mark A. Randolph, PhD '89, joined the Research Lab of Electronics (RLE) Speech Communication Group as a research scientist last September. Randolph will collect acoustic data on speech sounds in various contexts, extract acoustic properties, and identify spoken words from this acoustic data. . . . **William M. Rabinowitz**, PhD '77, was promoted to principal research scientist in the Sensory Communication Group of the RLE. Rabinowitz's research interests include auditory physiology and acoustics. He has served as a principal investigator on projects involving tactile communication and cochlear implants for the hearing impaired. . . . The American Physical Society has elected **Charles Fielding Finch Karny**, PhD '77, as a Fellow. His citation reads: for "contributions to the theory of stochasticity and its application to ion heating, and for the establishment, by numerical computation, of theories of current-drive by radio-frequency waves in tokamaks."

The following four are Fellow award recipients from the Boston Section of the IEEE. **Thomas E. Fortmann**, PhD '69, for "technical leadership in automated data analysis and multitarget tracking." Fortmann is currently at BBN Systems and Technologies Corp. in Cambridge, where he manages the Automated Systems Department. **Robert M.**

Lerner, ScD '59, for "contributions to the theory and design of pulse-compression radar and advanced communication systems." Lerner is a senior staff member at Lincoln Lab. **Roger H. Tancrrell**, SM '58, for "contributions to the analysis and design of surface-acoustic-wave filters for signal processing." Tancrrell is a consulting scientist with Raytheon Research Division in Lexington, Mass. **Dimitri A. Antoniadis**, for "contributions to the fabrication process modeling and simulation, and to field-effect quantum transport devices." Antoniadis is a Course VI professor and co-director of the MIT Microsystems Technology Labs.

VI-A INTERNSHIP PROGRAM

On March 7, the Institute held a day of celebration for the late **Harold E. "Doc" Edgerton**, '27. It culminated in an afternoon program in Kresge, attended by some 1,200 people, followed by a huge reception in the Stratton Student Center. Jacques-Yves Cousteau was one of the speakers at the Kresge meeting, as was Professor Emeritus **Truman S. Gray**, ScD '30, of the EECS Department, a fellow graduate student with Doc. Doc's life touched many in a very personal way and his presence around the Institute will be sorely missed.

Another death to report is that of **Leslie J. Weed**, SM '28, VI-A grad with whom I came in contact in my earlier pre-MIT career. Les co-opped with the Boston Edison Co. where he remained for his entire professional career. My contact with him came through my affiliation with the Boston Section of the AIEE (forerunner of the IEEE) where he and I were officers. I'd also meet him around town, after his retirement, as we both lived in Wellesley, Mass.

Many of you know **Horace M. Smith, Jr.**, from your contact with our Department Graduate Office where he served as assistant to Professor **Arthur C. Smith**. Horace was hospitalized for a little over a week in March when he suffered a heart complication. I'm glad to report that he is now home and functioning almost normally—though he has to curtail his pace a little.

More honors to VI-A alums. Amongst the IEEE's announced 1990 Field Awards, the Koji Kobayashi Computers & Communications Award is to be presented to **Elwyn R. Berlekamp**, PhD '64, a Fellow of the IEEE, "for profound contributions, in mathematical theory and engineering practice, to error-correcting codes for communications and data storage." He is both a professor of mathematics and a professor of electrical engineering & computer science at the University of California at Berkeley. Congratulations!

Joseph F. Keithley, SM '38, founder and chair of Keithley Instruments, Inc., established a Career Development Chair in the Department in 1985. He has now elevated this to a fully endowed chair named the "Joseph F. and Nancy P. Keithley Professorship in Electrical Engineering." EECS Department Head, **Paul L. Penfield, Jr.**, ScD '60, announced that the first holder of this new chair will be **Henry I. Smith**. Professor Smith is renowned for his research in improving the performance of electronic devices by shrinking the size of their parts, thus improving electron transit time. Last year he was elected to the National Academy of Engineering. Mr. Keithley was here for the ceremonies honoring Professor Edgerton and I had an opportunity for a short talk with him when he stopped by the VI-A Office. He serves on the EECS Department's Visiting Committee.

On March 5th, VI-A held its annual dinner in connection with the company visitations to interview and select the VI-A Class of '90. The dinner turned out to be a very special one for yours truly. At its beginning Director **Kevin O'Toole**, NE '57 (XIII), rose to make a special announcement—the dinner was to be dedicated to **John A. Tucker**, Hon '85, for his 18 years



R.P. Wiley



J.W. Mayo

as director of the VI-A Program. I had not the slightest inkling this was to happen and was completely overwhelmed. It was wonderful for me because so many of my longtime faculty and company associates were in the audience, many of whom had special commendations of their own which they presented to me afterwards.

It was wonderful, too, to see so many VI-A grads coming back to represent their companies in the selection process. As best as we can recollect, without the business cards we had hoped to collect, the list includes: **Eric Bier**, SM '88, Xerox PARC; **Michael P. Chin**, SM '87, AT&T/Bell Labs.; **Dean R. Collins**, SM '59, TI; **Michael K. Cronk**, SM '86, Tektronix; **Dean Daniels**, SM '82, IBM; **Chester M. Day, Jr.**, SM '58, Bellcore; **Charles B. Dietrich**, SM '58, Sarnoff Research Labs.; **Jenny M. Ford**, SM '82, Motorola; **Neil M. Haller**, EE '61, Bellcore; **Ellen (Blake) Leckband**, SM '80, Hewlett-Packard; **Joseph R. Otto**, SM '89, Hewlett-Packard; **Steven L. Rohall**, SM '88, Bellcore; **Craig L. Zarmer**, SM '84, Hewlett-Packard; and **Marc A. Zissman**, PhD '90, of MIT's Lincoln Lab.

Reported, recently, in *Science News*, is the development of minuscule mechanical memory arrays, logic elements, and oscillators onto silicon chips under the direction of **Dennis L. Polla**, EE '81, of the University of Minnesota at Minneapolis-St. Paul. The advantage of these chips is that they can continue to perform even amidst intense radiation, a condition that disrupts existing chips. Polla unveiled a demonstration chip at the IEEE Micro Electro-Mechanical Systems Workshop in Napa, Calif.

A person with whom I became acquainted, while a national officer of the Eta Kappa Nu Association in the late '50s, was **Anthony F. Gabrielle**, SM '50. He was with American Electric Power Co. at the time, a company participating in VI-A. Later he became affiliated with Gulf States Utilities Co., of Beaumont, Tex., where he is now listed in their 1989 annual report as VP for computer applications.

Two of our current VI-A students have won prizes in a contest run for Harvard and MIT students by Oracle Corp., in connection with their recruiting activities. Grand Prize #1, a trip for two to Hawaii plus \$500 in cash, went to junior **Fredric A. Mayus**, '91, a VI-A'r at NSWC. Grand Prize #2, a trip for two to the Mexican Riviera, went to senior **Joseph R. Babiec, Jr.**, '90. Joe is a VI-A'r at AT&T/Bell Labs and is this year's president of MIT's Tau Beta Pi Chapter as well as president of his class.

A letter from **Edward C. Giaino**, SM '75, included his latest business card which carries his promotion to VP for advanced development for Zetron, Inc., of Redmond, Wash. He and his wife are expecting their first child in July.

A telephone call from **Stephen M. Foster**, SM '90, tells us he's back from his trip to Germany, living in Cambridge, and working in Boston for Arthur Andersen Co.

Others who have stopped by the VI-A Office, with whom I've had pleasant chats, include: **Richard Ellis Dupuy**, SM '75, with Photon Kinetics in Beaverton, Ore. and **Mark A. Troy**, SM '84, with Hewlett-Packard in Santa Clara, Calif. We've

also learned that **Lori F. Lamel**, PhD '88, is currently in Paris, France, doing speech research.—**John A. Tucker**, Director (Emeritus) VI-A Internship Program & Lecturer; MIT, Rm 38-473, Cambridge, MA 02139.

VII BIOLOGY

Word from **Clemens E. Prokesch**, SM '45, in New London, Conn.: "I continue in the active practice of internal medicine. I am still VP of the German Society of Eastern Connecticut." . . . **Earle B. Weiss**, SM '57, is a senior pulmonary research scientist in the Department of Anesthesia Research at Brigham & Women's Hospital, Boston, Mass. He received the Chadwick Medal last March for "meritorious contribution to thoracic diseases" from the Massachusetts Thoracic Society. . . . The W.M. Keck Foundation has awarded MIT a Medical Research and Medical Education Grant to "further support the W.M. Keck Fellowship Fund in the Department of Biology." MIT is one of four institutions slated to share in the \$9,530,000 charitable grant. . . . A *Boston Globe* feature on "Looking to the Millennium" quoted **David Baltimore**, '61: "I don't think cancer will be a solved problem—but I think our new knowledge will let us design new drugs that are targeted to the specific molecular interactions involved in cancer and other diseases."

Miriam D. Manning, MPH '43, of St. Augustine, Fla., died January 20, 1990. Manning was a research assistant to Dr. Sidney Farber from 1957 until her retirement in 1977. She has taught high school English and science for 10 years, before studying at MIT, and after a stint as the country's first woman Public Health Officer in Hingham, Mass., she decided through the influence of **Alice Butler**, '43, to continue her studies in medical school and graduated from Tufts Medical School in 1949. In the span of her career she traveled widely, carrying out studies in the epidemiology of leukemia outbreaks and saw the prognosis of "certainly fatal" improve to continuing remissions. Manning was affiliated with several professional associations in addition to her membership in the American Medical Association.

VIII PHYSICS

Jacqueline N. Hewitt, PhD '86, was recently appointed assistant professor of physics, and has joined MIT's Research Lab of Electronics' Radio Astronomy Group. Hewitt's research interests include the application of high-resolution radio interferometry techniques to problems in astrophysics. Currently, she is working on several gravitational lenses (which were discovered as a result of her doctoral work in RLE), and is measuring the properties of nearby cool dwarf stars that show evidence of surface activity. She has also won the \$5,000 Annie Jump Cannon Award in Astronomy given annually by the American Association of University Women. . . . **Deborah Kuchnir**, '89, has won the Apker Award from the American Physical Society, the most prestigious award offered at the national level to undergraduates in physics. Deborah was the society's guest at its January meeting in Atlanta.

Several MIT alums have been elected to the American Physical Society as new Fellows. In the Division of Astrophysics, **Saul Rappaport**, PhD '68, was cited for "major contributions to our understanding of the evolution of binary stellar systems containing a compact member and for the determination of the masses of neutron stars." In the Division of Condensed Matter Physics, both **Peter B. Littlewood**, '77 and **Constantine Stassis**, PhD '70, were elected. Littlewood's citation reads: "for theoretical contributions to the understanding of charge-density wave materials." Stassis' reads: "for contributions to the understanding of

magnetic scattering of neutrons and the growth and studies of metallic single crystals at high temperatures." In the Division of Nuclear Physics, **William A. Friedman**, PhD '66, was cited for "many contributions to the understanding of statistical decay products of heavy-ion collisions, especially those involving final-state interactions."

A report published by the Union of Concerned Scientists entitled *Cool Energy: The Renewable Solution to Global Warming* is a new book written by **Michael Brower**, '81. . . . The Catholic University of America in Washington, D.C., has appointed **James W. Mayo**, PhD '64, as assistant academic VP for sponsored research. Mayo has more than 30 years experience in research, teaching, policy planning, and analysis in varied academic, federal, and industry posts. Most recently he was VP for marketing at Computer Technology Group, Ltd. . . . **Edwin E. Kintner** of Boonton Township, N.J., executive VP of GPU Nuclear Corp., has been elected a member of the National Academy of Engineering. He was elected by the Academy for his "significant contributions to the development of nuclear submarine propulsion, nuclear power operation, and management of magnetic fusion programs."

Nathan G. Park, III, PhD '48, of Little Compton, R.I., died on March 4, 1990. Parke was professor emeritus of computer science and theoretical physics at Roger Williams College in Bristol, R.I., where he taught from 1975 to 1983. Previously he carried out classified projects for the Air Force at Parke Mathematical Lab, which he founded in Carlisle, Mass., in 1951. . . . **Edgar Everhart**, PhD '48, of Bailey, Colo., died on January 14, 1990. He started his career as an instructor at Dartmouth College in 1948. He then went to the University of Connecticut for 19 years where he attained full professorship; from 1969-84, he was a professor of physics and astronomy at the University of Denver. Everhart served as the director of the Chamberlin Observatory from 1950-87. He was given an NSF grant on Astrophotography of Comets for a two-year study in 1985.

X CHEMICAL ENGINEERING

From Australia, **Peter Farrell**, SM '67, writes: "After five years as VP for R&D at Baxter Health Care, I am now chair and CEO of ResCare, Ltd., a manufacturer of products for treatment of respiratory disorders. ResCare has offices in both Sydney, Australia, and Minneapolis, Minn. I was recently made a member of the Australian Academy of Technological Science & Engineering and I'm also a member of the Australian government's Industry, Research, and Development Board." . . . A note from **Shantaram G. Kane**, ScD '71, in Bombay, India: "Since 1981, I have been the R&D manager with National Organic Chemical Industries. My activities include technical support to petrochemicals complex, development of processes/products as agrochemicals and fine chemicals, and synthesis of new molecules as future agrochemicals. With herbal medicine as a hobby since 1983, I have accidentally come across a natural product formulation with twin properties of resistance development and growth promotion in eukaryotic systems. I would be happy to give samples for investigations."

"As director of environmental affairs at USS-POSCO Industries in Pittsburgh, Calif.," writes **Mauritz J. Kallerud**, SM '62, "I have had the opportunity to help in a \$500 million modernization of American industry and a state-of-the-science environmental program." . . . **Philip M. Gross**, SM '63, is president of the Environmental Polymers Division at Warner-Lambert Co., in Morris Plains, N.J. He was formerly president and general manager of the Silicon Division of GE in Schenectady, N.Y. . . . The National Academy of Engineering has elected for membership **Nai Y. Chen**, ScD '59, senior scientist and research advisor, Mobil R&D Corp., Princeton, N.J., for "discovery of commercially important shape selective

catalytic processes for producing premium fuels and lubricants." . . . **Phillip R. Westmoreland**, PhD '86, assistant professor of chemical engineering at the University of Massachusetts, has been presented the 1990 General Electric Outstanding Teaching Award by GE and the College of Engineering. The Award recognizes excellence in classroom and research education at the undergraduate and graduate levels. Westmoreland, a member of the faculty since 1986, also conducts research in combustion chemistry and in plasma-enhanced chemical vapor deposition, a key process in manufacturing microelectronics. He was 1988-89 chair of the Western Massachusetts Section of the American Institute of Chemical Engineers.

The Alumni/ae Association has been notified that **Donald Quon**, ScD '49, of Edmonton, Alberta, Canada, died on September 23, 1989. No further details were provided.

XI URBAN STUDIES AND PLANNING

A note from **Elias N. El-Hani**, SM '75, in Safat, Kuwait: "I am actually project manager of a \$60 million (USD) construction job: the new headquarters building of the Arab Fund for Social & Economic Development (equivalent to the World Bank). The project was started a year ago and is due for completion in two year's time. Shoring and de-watering the site was a difficult exercise, due to the extremely varying soil conditions in the plot area. The building features an internal atrium clad with granite and stainless steel handrails overlooking a plaza. The structural design was checked by LeMesurier Consultants in Cambridge, Mass. On the personal level I now have a seven-year-old son, Nicolas, and a two-year-old daughter, Andrea. I promised them a visit to MIT this summer." . . . **Roger Labonte**, SM '62, writes: "I have given up a career as an environmental engineering professor at Ecole Polytechnique to become project director of international development projects in underdeveloped countries of the French-speaking world."

Edward H. Kaplan, PhD '84, reports: "I am associate professor at the Yale School of Organization & Management. I traveled to Budapest, Hungary, to present work on worst-case analysis of the AIDS epidemic. I have been an invited speaker at numerous conferences, including the American Mathematical Association, Operations Research Society, and Los Alamos National Labs."

. . . **Robert G. Bluhm**, MCP '78, an architect and urban planner, has joined the staff of the University of California at Berkeley as a capital projects manager, heading many of the university's major building and planning projects. . . . Since May 1988, **Julia Vindasius**, MCP '86, has been program director for the Good Faith Fund, a non-profit program of the Southern Development Bank Corporation in southern Arkansas. The fund is a self-employment loan fund modeled after the Grameen Bank of Bangladesh. . . . **Stephen Ervin**, PhD '89, is now an assistant professor of landscape architecture teaching design, technology, and computing at the Harvard Graduate School of Design. . . . **J. Alberto Harth-Deneke**, PhD '78, is currently an operations adviser in the office of the senior VP for operations at the World Bank. He's written staff directives on emergency assistance after natural disasters and involuntary resettlement. From 1984-88 he was deputy division chief (South Asia Division) for water supply & urban development, and concentrated in urban-project vending for Sri Lanka and Bangladesh. From 1980-84 he was working in Peru, Colombia, and Brazil, preparing World Bank urban projects. In El Salvador he was general manager of the Low Income Housing Foundation and briefly minister of economic and social planning from 1979-80. . . . **Riva Poor**, MCP '68, is preparing her book *Dysfunctional Patterns of Decision-Making and How to Get Rid of Them*, for publication this summer.

A symposium entitled "National and International Forces on the Growth and Change of Cities" was held in honor of Professor **Lloyd Rodwin** last March. **Lawrence E. Susskind**, PhD '73, was the symposium moderator. . . . **Hugh Carter Donahue**, PhD '85, assistant professor of journalism at Ohio State University and a research associate of MIT's Research Program in Communication Policy, married Martha Estelle Trudeau on December 9, 1989.

XII EARTH, ATMOSPHERIC AND PLANETARY SCIENCES

Sara Louise Bennett, PhD '88, writes from North Vancouver, British Columbia, Canada: "I have been living in Dhaka, Bangladesh, for over a year, working as an environmental specialist with several water resources development projects funded by CIDA, USAID, and the World Bank. Environmental activities in Asia are expanding rapidly, and are presenting many challenges: e.g., resolving subsistence/conservation conflicts; the difficulties of designing environmental protection systems that are self-enforcing (i.e., contain economic or social incentives); and assigning value to environmental services rendered by the commons." . . . **Robert B. Singer**, PhD '80, writes: "Since 1987, I have been an associate professor in the Planetary Sciences Department of the University of Arizona in Tucson. I also founded and direct the Planetary Image Research Lab (PIRL) at the University. PIRL is devoted to innovative and multidisciplinary applications of image processing and remote sensing to scientific research. We currently consist of about 10 people—staff and students—and a network of Sun computers. My own research concentrates primarily on the surface composition of Mars, as determined by telescopic and spacecraft observations. I am also involved in global-change activities at UA."

According to an article in the *Wall Street Journal*, **Chien-Min Sung**, PhD '76, free on a \$1 million bond, has been accused of purloining thousands of documents from Norton Co. and former employer General Electric Co. and selling them to South Korean and Chinese firms and possibly the Soviet Union. The documents included GE's "cookbook" for making high-quality industrial diamonds. Sung's expertise is saw-grade diamonds; while at GE he developed a way to raise the number of carats per production run and a technique to make larger diamonds. He denies any wrongdoing and maintains there was nothing illegal or improper with his private practice. Sung's probable defense is that he has a right to sell his knowledge as a synthetic-diamond expert, but the suit contends Sung was peddling much more.

Dennis A. Miller, SM '78, writes: "I am working on software development for the NEXRAD (Next Generation Weather Radar) project. NEXRAD radars, with Doppler capability, will be installed throughout the U.S. during the 1990s."

Keith J. Stewart, '56, of Ottawa, Ontario, Canada, died on February 12, 1990. He had retired from Energy, Mines, and Resources. No further information was provided. . . . **Victor M. Lopez**, PhD '37, of Caracas, Venezuela, died last year. There was no additional information available.

XIII OCEAN ENGINEERING

Albert F. Suchy, OCE '80, writes: "I'm currently chief of the Fleet Systems and Equipment Branch of the Naval Engineering Division at the Coast Guard headquarters. Recent events include a successful test firing of the newly installed Harpoon Missile System off a Coast Guard high-endurance-class cutter. . . . Commander **William C. Gibson**, NA '51, is a marine surveyor at Riggs Marine Appraisals, Ltd. The company was chartered in 1972 by professionals with court-tested appraisals of marine properties; capital stock transferred in 1981 to sailing architects and engineers."

Lieutenant Commander **William L. Glodt**, NE '49, reports: "I am retired after working with the FAA on advanced automation of national airspace." . . . Captain **Joseph L. Coburn, Jr.**, NE '61, is the marine operations manager at Woods Hole Oceanographic Institution, which offers a joint degree with MIT. . . . Captain **Robert L. Evans**, SM '37, reports: "I have been New Hampshire's 'Math Counts' state coordinator since 1984. I'm hopefully preparing New Hampshire seventh & eighth grade students for future MIT studies!" . . . Commander **John F. McGowan**, OCE '76, is the commanding officer of the U.S. Coast Guard's Marine Safety Office in Portland, Maine.

XIV ECONOMICS

Chris Tilly, PhD '89, writes: "I'm teaching in the Economics Department at the University of Lowell (Mass.), but will be returning to MIT as a visiting professor in the Department of Urban Studies and Planning for academic year 1990-91." . . . **Margaret Garritsen DeVries**, PhD '46, reports: "I am writing an autobiographical work focusing on the changes in lifestyles as a result of economic changes and trends in the United States that I have witnessed in my lifetime."

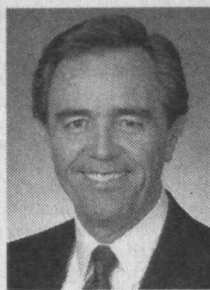
XV MANAGEMENT

Yokio Ito, SM '78, writes: "The Mitsui Bank, Ltd., where I work, is going to merge with Taiyo Kobe Bank to chase the benefit of the size. I expect a busy preparatory stage involving all employees." . . . A note from **Lisa Dickinson**, SM '77, reports: "On April 1 I joined DuPont Co., Inc., in Charlotte, N.C., as senior VP. It is a small entrepreneurial company specializing in the sale of pre-owned (used) plants to the U.S. and less developed countries. I will be involved in selling as well as arranging financing for our sales. Lines include food processing, paper and board, power, and chemicals. I will be living in South Carolina on a lake—a great improvement over Manhattan." . . . **Julius Bellaschi**, SM '58, is director of the Program Analysis and Evaluation Directorate, Department of the Army. He published a book entitled *To Lead and Manage* (MJ Publications, 1980). His book ideas originate from a course taken at Sloan management pioneer **Erwin Schell** in 1957. . . . **Tommy Gardner**, SM '88, is serving as executive officer of the USS *Norfolk* (SSN 714). . . . A note from **Stephen Pearce**, SM '82, in Overland Park, Kans.: "I am director of software development for U.S. Sprint. After graduation from Sloan, I worked for AI&T for eight years. In that time, my family moved eight times in as many assignments (including engineering, operations, Bell Labs, marketing, systems software, and planning). I moved to Kansas City in 1989. Betsy and I now have three children: Scott, 6, Katy, 4, and Jim, 2. Betsy is successfully freelancing interior design work. My current challenges include managing staff in San Francisco and Kansas City, helping the staff grow, and developing new products and services." . . . A brief note from **John M. Reade**, SM '75, in Lancaster, Ohio: "In February 1990 I started with International Pressure Service (IPS) as president and CEO. IPS is a leader in hot and cold isostatic pressing equipment/systems and service (HIP & CIP)." . . . "I have been designated manager of the newly created Merchant Banking Division at Atlantic Security Bank," writes **Jorge R. Peschiera**, SM '75. "Our business development efforts will concentrate in Latin America."

Dennis B. Sullivan, SM '86, sends word: "I am with the firm of Canby, Maloney, & Co., Inc., certified public accountants. Within the firm, I head up the business planning and employee benefits tax group. The firm specializes in serving the needs of private businesses and individuals



C.K. McLeod



C.D. Peterson

regarding the full spectrum of their financial affairs. We advise new businesses in need of financing, in addition to strategic tax planning and compensation arrangements including employee stock ownership plans, stock options and deferred compensation arrangements. I am an attorney and a member of the Mass. Society of CPAs and the American Institute of CPAs as well as the Institute of Business Appraisers." . . . **Patrick D. Centanni**, SM '81, has moved up from assistant VP to VP at State Street Bank in North Quincy, Mass. . . . **Vinod K. Dar**, SM '75, is now senior VP for Gas Transportation & Marketing with American Exploration Co., in Houston, Tex. He was previously managing director at RCG/Hagler, Bailly, Inc. . . . **Michele F. Demarest**, SM '79, has assumed the position of treasurer at Boston's Charles River Associates. She had been the company's controller. . . . **Kenneth A. Matheson**, SM '51, has retired from the presidency of Armstrong World Industries Canada Ltd. in Montreal, a subsidiary of Armstrong World Industries, Inc.

The MAC Group, an international management consulting firm, has announced the promotion of **Robert B. Hedges, Jr.**, SM '84, to VP. Hedges joined the firm in 1984 and specializes in corporate strategy, organization, and performance improvement in the financial services industry, particularly for super-regional banks. . . . Capital Markets Assurance Corp (CapMAC), a financial guaranty company and subsidiary of Citicorp, has named CapMAC Senior Vice-President **Maheesh K. Kotecha**, SM '74, to be marketing director of an expanded marketing department. He joined the company in April 1989, after two years as a senior VP and shareholder at Kidder Peabody. . . .

Christopher K. McLeod, SM '79, has been elected to the Sacred Heart University board of trustees. McLeod is president of the Comp-U-Card Division of CUC International in Stamford, Conn., and executive VP of the parent company, which is based in New York. His extensive experience in business includes senior management responsibility for operations, manufacturing, and merchandising.

Carlyle S. Dewey, III, SM '57, of Manchester, Conn., died on January 27, 1990. He was a consultant and retired sales engineer for Westinghouse Electric Corp. in Hartford, Conn.

Sloan Fellows

Albert J. Gravalles, SM '68, reports: "I am VP and manager of the eastern region at Daniel, Mann, Johnson & Mendenhall (DMJM), an international architectural engineering and planning firm. We were recently selected to be the executive architectural engineering manager of a \$1.5 million, 10-year Pentagon renovation." . . .

Chester W. Diercks, Jr., SM '62, of Marietta, Ga., retired October 1, 1989, as president and CEO of Utility Power Corp. . . . **Roswell L. Derby**, SM '54, has retired as senior VP at Heritage Bank in Holyoke, Mass. . . . British Petroleum Co., London, England, has promoted **Robert B. Horton**, SM '71, from deputy chair to chair and CEO.

Eastman Kodak Co., of Rochester, N.Y., has made several corporate changes involving MIT alumni/ae. Effective June 1990, **Colby Chandler**,

SM '63, chair and CEO, will retire. Assuming those titles is **Kay R. Whitmore**, SM '75, Eastman Kodak's current president and executive officer. **J. Phillip Samper**, SM '73, has retired as the company's vice-chair and executive officer. **William F. Fowble**, SM '82, is Eastman Kodak's new president of photographic products. Fowble will continue as senior VP and general manager of manufacturing.

Donald H. White, SM '70, has retired from his position as president and COO of Hughes Aircraft Co., Los Angeles, Calif. . . . **David A. Burgner**, SM '86, is the new transition project manager at the Saginaw Division of Hydra-Matic Plant in Three Rivers, Mich. He was previously the plant manager at Packard Electronics in Warren, Ohio. Hydra-Matic is a subsidiary of and Packard a division of General Motors Corp. . . . Caterpillar, Inc., has promoted **Donald V. Fites**, SM '71, to chair and CEO from president of the Peoria, Ill.-based company. . . . Lista AG of Erlen, Switzerland, a manufacturer and distributor of industrial storage equipment, has named **C.D. "Pete" Peterson**, SM '72, president of U.S. Lista International, based in Holliston, Mass. Peterson has held senior executive positions at multinational companies such as International Paper and Merrill Lynch. . . . **William Bucknall**, SM '80, has been named VP for human resources at Carrier, the division of United Technologies Corp. that manufactures heating & air-conditioning equipment. Bucknall was corporate director of compensation and benefits at UTC's corporate office. He has held a variety of positions within UTC, including management posts at Pratt & Whitney and Otis.

The Alumni/ae Association has been notified of the following deaths: **Kenneth E. Bowen**, SM '53, of Springfield, Ill., died in August, 1989; **John McNicholas**, SM '86, of Calgary, Alberta, Canada, died on November 3, 1989; and **Joseph Franklin Tobias**, '55, of Penn Valley, Calif., died on December 19, 1989. There was no additional information provided.

Senior Executives

Herbert D. Wedge, '82, reports from Roseburg, Ore.: "I retired from M.A. Hanna Co. as general manager of nickel and silicon operations in 1988. I started Wedgwood Enterprises to cover a variety of services. At present, the major activity is pyrometallurgical consultation and rentals. We expect to add diverse activities as opportunities become available." . . . At Phillips Petroleum Co. in Bartlesville, Okla., **Charles F. Cook**, '73, has moved from VP for R&D to VP for alternative fuel development. . . . **Daniel T. Jacobsen**, '75, has retired as chief auditor of Citicorp, New York, N.Y. . . . **Michael F. Mee**, '84, formerly CFO and director of Norton Co., has become executive VP and CFO of Wang Laboratories, Inc. . . . Chevron Research & Technology Co., Richmond, Calif., has a new president, **J. Kent Murray**, '83. Murray had been general manager of organizational development & compensation at Chevron Corp.'s San Francisco office. . . . **Thomas G. Avant**, '79, is VP for strategic planning at Ethyl Corp. in Richmond, Va. Previously, he was the strategic planning director.

James W. Wogslund, '87, currently Caterpillar's executive VP, will assume the position of vice chair of the Peoria, Ill., company on July 1, 1990. . . . **Joan B. Berkowitz**, '79, and Alan L. Farkas, both consultants in the environmental services field for more than 15 years, have joined forces and created Farkas Berkowitz & Co. The Washington, D.C.-based firm will help companies compete effectively in the hazardous waste management industry. Berkowitz was VP in charge of hazardous waste consulting at Arthur D. Little, Inc., and later served as president and CEO of an environmental consulting subsidiary of a major insurance company. She is chair of the American Chemical Society's committee on environmental improvement, an editor of the journal *Hazardous Waste*, and a member of the

environmental engineering committee of the EPA's Science Advisory Board.

The Alumni/ae Association has been notified that **Thomas F. Neal**, '59, of Pinehurst, N.C., died in May, 1989.

XVI AERONAUTICS AND ASTRONAUTICS

Ross M. Jones, SM '78, reports from La Canada, Calif.: "I have been at the Jet Propulsion Lab for about 10 years. Currently I work in the Spacecraft Systems Engineering Section and am a spacecraft system engineer on NASA's Mars Observer project, which will launch a spacecraft to Mars in 1992. Recently I have initiated work on "microspacecraft" using technology developed by the SDI program and the new field of micromechanical systems." . . . **Dino A. Lorenzini**, ScD '70, has accepted a new position as VP for operations with Interferometrics, Inc., in Vienna, Va. . . . **Captain Creighton W. Cook**, SM '54, of Big Bear Lake, Calif., writes: "I retired as captain in the U.S. Navy in 1973 and retired from a position in business development at Lockheed California Co. in 1986. I'm currently self-employed as an aerospace consultant in the Los Angeles area." . . . **Andrew I. Lowenstein**, PhD '74, reports: "I've started an R&D lab in Princeton, N.J., working on desiccant air conditioning, thermal storage, and advanced electric water heating."

From Horsham, Penn., **Ronald L. Nave**, SM '70, writes: "I am currently operating a one-man engineering and software consulting business out of my home. Business has been a little slow lately and I am working on a second BS degree in computer hardware design at Drexel University in an attempt to diversify from helicopter simulation software. My wife, Victoria, is a research medical technologist at Rohm & Haas and my daughter, Ellen, just started first grade. At the moment I am marketing myself as a PC/VAX engineering application software developer using Fortran and 'C'." . . . **Jack D. Howell**, SM '72, has been named deputy director of the Federal Aviation Administration Technical Center. As deputy director, Howell will co-manage a work force of 2,000. He will oversee development of the national air-space system plan, FAA's \$15.8 billion project to automate the entire air traffic control system. Howell was a first officer, serving as co-pilot on the L-1011 airliner at Eastern Air Lines. . . . **Rodney L. Jacobs**, SM '63, has been named CFO of Wells Fargo & Co. Before the promotion, he was executive VP for financial planning and analysis in the bank's finance group. Jacobs joined Wells Fargo in 1979 as a financial analyst in the bank's management sciences department. He was named VP of that department in 1981 and senior VP in 1983. As head of the financial planning and analysis group, he was responsible for management reporting, management sciences, and treasury and was named executive VP in 1988.

Janice Voss, PhD '87, was one of 23 astronauts selected by NASA to train for future space shuttle assignments for the U.S. space program. Voss is employed by Orbital Science Corp. in Houston. . . . **Myron Kayton**, PhD '60, writes: "My latest book, *Navigation: Land, Sea, Air and Space*, was just published by the Institute of Electrical and Electronic Engineers' Press, New York. It is a comprehensive tutorial on the technology of navigation. I describe the distinctive complement of sensors and software that has evolved for each type of vehicle. I explain how navigation technology has been built upon earlier technologies, such as ancient boat travel and astronomy. I describe geodesy as the underpinning of navigation, in each historical era." . . . **Michael S. Valdez**, '90, a senior in Course XVI, has won the department's 1989-90 General **James H. Doolittle** Scholarship, made possible by Gen. Doolittle, ScD'24, and Allied-Signal Corp. Valdez, who has a minor in music, was cited for excellence in aca-

demical work and his breadth of interests.

John E. Kirk, SM '49, of Austin, Tex., died on January 7, 1990. Kirk worked for Draper Laboratory over three periods, including positions as a deputy associate director from 1954-57, an associate director from 1960-65, special assistant to the president from 1971-73, and VP from 1973-81. Kirk directed the groups responsible for development and test of the Thor and Titan Guidance Systems during his first tour at Draper. He was responsible for all inertial guidance developments for the Air Force Ballistic Missile Program during his second period of service. As VP, he was involved in the process of revising the Lab's organization and fiscal affairs in preparation for divestment from MIT in 1973. Kirk held various government posts between his positions at Draper. He had served as a naval officer aboard a destroyer where he witnessed the bombing of Pearl Harbor. Later he qualified as a naval aviator, finishing the war in the Pacific as an F-4 U pilot. . . . **Mark A. Smith**, SM '64, of Sharon, Conn., died on January 22, 1990. He retired as an engineer in 1974 from Draper Lab where he worked on the Titan Missile and wrote several books on finance and computers. . . . **Captain Edward H. Guilbert**, SM '41, (USN Ret) of Pensacola, Fla., died on January 14, 1990. He was an overhaul and repair officer at Pensacola Naval Air Station and retired from the U.S. Navy in 1955, with 28 years of service. Guilbert taught astronomy at Pensacola Junior College and was instrumental in establishing the planetarium of which he served as the first director.

XVII POLITICAL SCIENCE

Charles A. Duelfer, SM '77, writes: "I am currently deputy assistant secretary for defense trade in the Politico-Military Bureau at the Department of State." . . . From Eugene, Ore., **Carl Hosticka**, PhD '76, sends word: "I was elected to be the Majority Leader of the Oregon House of Representatives. I was also recently appointed associate VP of the University of Oregon." . . . **Amy E. Blitz**, SM '90, a graduate student, has won the \$5,000 third prize in the 1989 Wilson Center Media Studies Essay Competition for her essay, "The Press and Foreign Policy: A Case Study of the *New York Times*' Coverage of the Philippines." The judges cited her for "the interesting results of your research and the originality of your analysis."

The fifth edition of *Technology and the Future* (St. Martin's Press, New York), edited by **Albert H. Teich**, PhD '69, has been published in association with the AAAS. A quote from the book jacket says "This should be required reading for every college student. It is imperative that we all be well informed and capable of making intelligent decisions about how technology continues to affect our lives." . . . **Herbert Rubin**, PhD '72, professor of sociology at Northern Illinois University, is teaching a class called "Organizing for Social Action." In the class, Rubin, using his book *Community Organizing and Development*, teaches students that "protest is as American as apple pie." Rubin emphasizes both a responsibility and



J.D. Howell



R.L. Jacobs

Lahive & Cockfield

Intellectual Property
Law Including Patent,
Trademark,
Copyright, Unfair
Competition, Biotech-
nology and Computer
Law, Antitrust and
General Litigation.
Litigation in all
Courts.

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John A. Lahive, Jr.
W. Hugo Liepmann '57
James E. Cockfield
Mark G. Lappin '64
Edmund R. Pitcher
Thomas V. Smurzynski

Ralph A. Loren
Thomas J. Engellenner
William A. Scofield

David J. Powsner '81
William C. Geary
Michael I. Falkoff
David A. Jacobs '80
Damon J. Borelli
Ann T. Lamport
Elizabeth F. Enayati

Of Counsel

Jeremiah Lynch

Technical Specialist

Anne-Louise Kerner, PhD
Robin D. Kelley '88

a necessity for questioning authority. According to a university press release, Rubin says, "Law is a reification (making an abstract idea concrete) of power struggles. People aren't being illegal by questioning the law."

XVIII MATHEMATICS

Robert A. Leonard, '57, writes that he "is president of Ticketmaster Corp., the world's largest computerized ticketing company with 1989 gross sales exceeding \$1 billion." According to a Ticketmaster press release, "Leonard attributes the company's continued success and dramatic growth to its focus on customer service and innovation, providing clients with state-of-the-art equipment, software, and support. Recent technological advancements include the TM 90 + Micro VAX II System, which provides approximately three times the speed and five times the capacity of previous ticket-selling systems. Ticketmaster services more than 110 cities throughout the United States, Canada, Europe, and Australia." . . . **Jerry Grossman**, PhD '74, sends word from Rochester, Mich.: "My new textbook, *Discrete Mathematics*, has just been published by Macmillan. It is aimed toward sophomores majoring in mathematics or computer science."

Retired mathematics professor **Dirk Jan Struik** has received a major new honor—the first Kenneth Ownsworth May Prize for History of Mathematics. Struik, who is 95 and lives in Belmont, Mass., says he "never felt better," and traveled to Hamburg, Germany, last August to receive the prestigious prize at the 18th International Conference on the History of Science. It was presented to Struik by the International Commission on the History of Mathematics and the International Union of the History and Philosophy of Science "in recognition of an outstanding career devoted to scholarship and the international appreciation of the history of mathematics." He shared the prize with Professor A.P. Juschkewitch of Moscow. Struik came to MIT as a lecturer in 1926, became an assistant professor two years later, advanced through the faculty ranks to full professor and became emeritus in 1960. He is the author of several books in the fields of mathematics and the history of science. . . . MIT Professor of Mathematics **Steven Kleiman**, '61, was awarded an honorary doctor's degree by the University of Copenhagen in ceremonies attended by the Queen of Denmark. The citation noted "his scientific work within algebraic geometry and within enumerative geometry where today he is the most outstanding

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Rod Campbell '81
Randy Frazier '72
Don R. Widrig '65

exponent for the application of the theory of intersection."

The IEEE has elected **Robert M. Lerner**, ScD '59, and **Joel Moses**, PhD '69, as Fellow Award recipients. Lerner was cited for "contributions to the theory and design of pulse-compression radar and advanced communication systems." Lerner, a senior staff member at Lincoln Lab since 1952 (except for academic leaves), has contributed to the design and development of systems that use sophisticated signal structures, including the FPS-17 radar, the LES experimental communications satellites, and Milstar. He was also one of the pioneers in non-fiber optical communication technology, with experiments and simulations of optical scattering through clouds and water. At the device level, he developed and adapted a variety of tapped delay lines and other dispersive media for signal processing. He originated a class of sharp cutoff, linear phase filters known as Lerner filters. He holds patents on an earth penetration radar system and on a scheme for combatting impulse noise. Moses was cited for "leadership in the development of symbolic algebraic manipulation systems." Moses has been a professor of electrical engineering at MIT since 1967, and is currently a visiting professor at the Harvard Business School. He led the development of the MACSYMA system for formula manipulation, the largest computer system for formula manipulation available today. His areas of interest include the organization of large complex systems, competitiveness, knowledge-based systems, learning, computers and education plus symbolic manipulation.

Alan J. Perlis, PhD '50, of Woodbridge, Conn., died on February 12, 1990. Perlis, the Eugene Higgins Professor of Computer Science at Yale University, was known as one of the country's leading scholars and researchers of computer programming language design and techniques. He joined the Yale faculty in 1971 and was chair of the computer science department in 1976-77 and 1978-80. Before teaching at Yale, he had been a professor at the Carnegie Institute of Technology, now Carnegie-Mellon University, joining the faculty in 1956. Perlis was a research mathematician with Project Whirlwind at MIT in 1948, 1949, and 1952. He was assistant professor and head of the computing laboratory at Purdue University from 1952-56, where he was responsible for forming the institution's digital computer laboratory. Perlis was one of eight researchers to define the programming language Algol 58 and in 1960 he was one of 13 international scientists involved in the definition of Algol 60, which was considered the computer language of the 1960s.

XX APPLIED BIOLOGICAL SCIENCES

W.J. Goldman, SM '64, sends word from Ambler, Penn., that he is associate director of clinical research for McNeil Consumer Products Co.

XXI HUMANITIES

Caroline Whitbeck, PhD '70, senior research scholar at the Center for Technology, Policy and Industrial Development and senior lecturer in the Department of Mechanical Engineering, recently took part in an invitational conference, "Science Policy in a New Context," in the Netherlands. It was sponsored by the Dutch Ministry of Education. She addressed ethical issues raised by R&D

in science and technology and by recent proposals for science policy. . . . **Barbara Hall Partee**, PhD '65, professor of linguistics and philosophy at the University of Massachusetts at Amherst since 1972 and head of its Linguistics Department since 1987, has been appointed to the board of managers of Swarthmore College. Partee, an internationally known scholar of theoretical linguistics, has been on the editorial boards of *Language*, *Linguistic Inquiry*, *Linguistics* and *Philosophy* and *Theoretical Linguistics*.

XXII NUCLEAR ENGINEERING

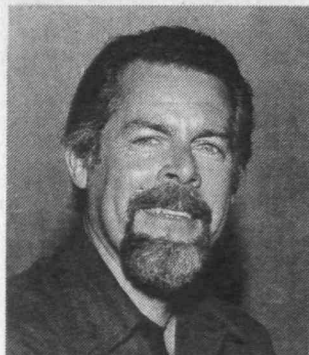
Jeffrey H. Musk, SM '88, writes: "I've recently returned from South Korea where I spent the last year with the Army. I'm now serving as a nuclear physicist at the Armed Forces Radiobiology Research Institute in Bethesda, Md." . . . A note from **Steve Dipietro**, SM '81, in Merrimack, N.H.: "I am now at Textron Specialty Materials in Lowell, Mass., working on ceramic matrix composites and thin film technology. I am anxious to rekindle my friendships with classmates and MIT Reactor Lab people." . . . **James D. Callen**, PhD '68, Donald W. Kerst Professor of Nuclear Engineering and Engineering Physics at the University of Wisconsin, Madison, has been elected a new member of the National Academy of Engineering for "pioneering work in the development of models of neutral beam heating, tokamak discharge macroscopics, and anomalous (turbulent) transport in plasmas."

Theodore A. Postel, PhD '76, has been named recipient of the 1990 Leo Szilard Award. The citation reads, "For his incisive technical analysis of national security issues that has been vital for informing the public policy debate, especially with regard to basing modes for ballistic missiles, survivability of submarines, effects of nuclear war, effectiveness of tactical ballistic missiles, and implications of accidental launch protection systems."

TPP TECHNOLOGY AND POLICY PROGRAM

Mark McCabe, SM '86, is completing a PhD in economics at the Sloan School. . . . **Daryl Beardsley**, SM '82, has returned to the Boston area and is consulting in industrial waste reduction, the subject of her thesis. She presented a paper describing her computer models in Geneva, Switzerland, in 1989. . . . **Pascal Remy**, SM '87, has been promoted to directeur adjoint, in charge of foreign subsidiaries of CEGE LES. . . . **Scott Weingaertner**, SM '87, is at the University of Pennsylvania Law School.

Steve Stewart, SM '85, is with IBM in Gaithersburg, Md., where he has been the manager of the Cost Engineering Department for the last three years. . . . **Christoph Hilz**, SM '90, has returned to Luxembourg and is working with the European Parliament. . . . **Scott Pace**, SM '82, completed his dissertation in public policy at the Rand Graduate School last June. The title was "U.S. Access to Space: Launch Vehicle Choices for 1990-2010." He also gave a paper on a portion of the dissertation at a symposium on space economics at the 40th Congress of the International Astronautical Federation in Malaga, Spain, last October. . . . **Erin Craig**, SM '89, recently had an addition to her family. Kimberly Anne Dvorak was born on January 17, 1990.—Richard de Neufville, MIT, Room E40-252, Cambridge, MA 02139.



Peter M. Close

Peter M. Close, MIT sports information director and coach for cross-country and track for many years during the 1960s and '70s, died of colon cancer on March 13 at the Miles Health Care Center, Damariscotta, Maine. He was 52.

Close was sports information director from 1962 to 1976, and cross-country coach from 1972 to '77. In 1964 and again from 1974 to '77, he was the assistant track coach. MIT cross-country teams won 30 meets and lost 13 during his tenure.

His coaching successor at MIT, Chris Lane, now headmaster of Dorchester High School, was quoted in the *Boston Globe* obituary as saying that Close "got athletes to believe in themselves. All those he touched achieved beyond their potential."

Close was a member of the U.S. track team in the 1960 Olympics, but did not survive qualifying heats in the 1,500-meter run.

After serving as track coach at Tufts for several years, Close moved to Maine. He lived in Waldoboro and since 1987 had been director of housing for the Midcoast Human Resources Council in Rockland. □

Rear Admiral

**Ernest C. Holtzworth,
1908-1989**

Ernest C. Holtzworth, SM '36, professor of naval construction at MIT after World War II, died on May 15, 1989, in Scottsdale, Ariz. He was 81.

Holtzworth served as head of the War Analysis Branch of BuShips during the war. In 1945, he joined the faculty at MIT, where he directed the 13A program for three years. He subsequently commanded the Pearl Harbor and New York Naval Shipyards, and retired from the Navy in 1964. □

Deceased

The following deaths have been reported to the Alumni Association since the *Review* last went to press:

Francis Hann, '15; June, 1989; Beverly Hills, Calif.
Frank G. Darlington, '16; March 3, 1990; Leetsdale, Penn.
Aubrey P. Ames, '19; March 11, 1990; San Francisco, Calif.
Albert V. Dumas, '20; March 19, 1990; Montreal, Quebec, Canada
Elliott T. Adams, '21; March 27, 1990; Newton, Mass.
Francis L. Blewer, '21; February 23, 1990; New York, N.Y.
Edmund E. Brady, '21; February 15, 1990; Washington, D.C.
Franklin Mitchell, '21; February 26, 1990; Bridgewater, Mass.
Joel Y. Lund, '23; March 5, 1990; Charleston, S.C.
Donald G. Bertch, '24; February 16, 1990; Charlestown, R.I.
Richard F. Hayward, '25; July, 1983; Bluemont, Va.
Thomas I. Dowling, '26; August 30, 1989; Washington, D.C.
Wallace K. Newcomb, '26; November 11, 1989; Buffalo, N.Y.
William Engs, '27; February 25, 1990; Chatham, Mass.
Jacob Berkover, '28; February 16, 1990; Peabody, Mass.
Albert J. Carey, '28; April 7, 1990;
Lewis S. Coonley, '28; March 10, 1990; N. Fort Myers, Fla.
Edward H. Holmes, '28; February 15, 1990; Kingston, Mass.
Ralph H. Martz, '28; November 4, 1989; Lombard, Ill.
Dennistoun W. Ver Planck, '28; October 8, 1989
Mrs. Charles E. Worthen, '28; December 2, 1989; Lincoln City, Ore.
Benjamin Clark Boeckeler, '29; January 28, 1990; Concord, N.H.
Hazen E. House, '29; November 17, 1989; Knoxville, Tenn.
L. Malcolm Mosher, '29; December, 1987; Marshfield, Mass.
Richard S. Roberts, '29; February 13, 1990; Newark, Del.
Clarence E. Worthen, Jr., '29; January 18, 1990; Orleans, Mass.
Lester D. Flory, '30; January 2, 1990; Fort Belvoir, Va.
Fairleigh E. Smith, '30; July 6, 1980; Longboat Key, Fla.
Adelaide Stanley, '30; 1990; Walnut Creek, Calif.
Otto Whitmore Burtner, Jr., '31; February 8, 1990.
Samuel A. Janney, '31; August 2, 1988; Gloucester, Va.
Charles E. Larkin, '31; January 30, 1990; Winchester, Mass.
Alexander L. Pavlo, '31; February 26, 1990; Brooklyn, N.Y.
Ernest B. Whitworth, Sr., '31; December 15, 1989; Charleston, Ill.
Thomas H. Anderson, Jr., '32; February 2, 1990; San Rafael, Calif.
Don Eustace B. Corson, '32; December 27, 1989; Leicester, N.C.
Donald K. Morgan, '32; February 26, 1990; Webster Groves, Mo.

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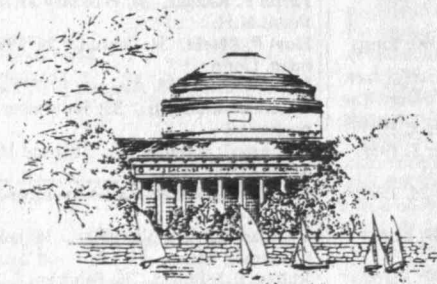
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Francis R. Smith, '32; February 11, 1990; South Easton, Mass.
Edward D. Stevens, Jr., '32; May, 1978; Sewickley, Penn.
W. Clinton Backus, '33; January 22, 1990; Los Angeles, Calif.
Robert Forbes, '33; March 11, 1990; Louisville, Tenn.
Lloyd H. Matson, '33; November 12, 1987
George L. Seavey, '33; January 11, 1990; Lynnfield, Mass.
Eugene H. Williams, '33; February 12, 1990; Dearborn, Mich.
Louis K. Frank, '34; January 16, 1990; Chestnut Hill, Mass.
Ralph P. Ranger, '34; February 27, 1990; Stratham, N.H.
Hoyt P. Steele, '34; February 24, 1990; New Canaan, Conn.
Buckley Crist, '35; August, 1977; Plainfield, N.J.
Albert deRoode, Jr., '35; September 8, 1988; Kaneohe, HI
Thomas C. Keeling, Jr., '35; June 16, 1989; Hilton Head Island, S.C.
Lowell J. Lammers, '35; November 3, 1989; Baytown, Tex.
Thomas Ledyard Blakeman, '36; January 31, 1990; Cataumet, Mass.
Robert F. Johnson, '36; February 6, 1990; Swampscott, Mass.
Victor M. Lopez, '36; 1989; Caracas, Venezuela.
John E. Sullivan, '36; January 16, 1990.
Chester F. Chollis, '37; January 17, 1990; Pennsville, N.J.
Joseph A. Guerin, '37; June 21, 1989; Manchester, N.H.
Charles M. Johnson, '38; January 24, 1990; Springfield, Mass.
John H. Phillippi, '38; November 27, 1989; Largo, Fla.
Benjamin M. Siegel, '38; March 22, 1990; Ithaca, N.Y.
F. Wallace Tobin, '39; January 29, 1990; Philadelphia, Penn.
Herbert A. Bing, '40; March 21, 1990; Ossipee, N.H.
I. Seth Levine, '40; February 21, 1990; West Redding, Conn.
Asher B. Robbins, Jr., '40; January 11, 1990; Alexandria, Va.
Henry Auerbach, '41; January 23, 1990; Attleboro, Mass.
Edward H. Guilbert, '41; January 14, 1990; Pensacola, Fla.

Owen L. Gore, '42; October 21, 1989; St. Thomas, V.I.
Richard B. Adler, '43; February 6, 1990; Concord, Mass.
Miriam D. Manning, '43; January 20, 1990; St. Augustine, Fla.
Franklin H. Swenson, '43; January 28, 1990; Chippewa Falls, Wis.
Peter G. Von Wiesensthal, '43; February 20, 1990; New York, N.Y.
Joseph C. Crowley, '44; January 6, 1990; Wayland, Mass.
Benjamin L. Lemmer, Jr., '45; September 30, 1989; Naples, Fla.
John E. Taylor, '46; June 7, 1988; St. Louis, Mo.
John E. Breen, '47; January 4, 1990; Framingham, Mass.
Thomas R. Eddy, '47; October 14, 1989; Pleasant Hill, Calif.
Eric A. Grubb, '47; July 6, 1989; Chilliwack, B.C., Canada.
Edward Rudge Allen, Jr., '48; January 5, 1990; Houston, Tex.
Melvin H. Berkowitz, '48; February 8, 1990; Newton Center, Mass.
Edgar Everhart, '48; January 14, 1990; Bailey, Col.
Nathan G. Parke, III, '48; March 4, 1990; Little Compton, R.I.
John E. Kirk, '49; January 7, 1990; Austin, Tex.

Alan J. Perlis, '49; February 12, 1990; Woodbridge, Conn.
Donald Quon, '49; September 23, 1989; Edmonton, Alberta, Canada.
Walter M. Swarthout, '49; March 20, 1990; Northbridge, Calif.
Charles D. Nolan, '50; January 13, 1990; Wayzata, Minn.
Harold M. Rich, '51; October 5, 1989
George Herny, '52; May 23, 1989; Norwell, Mass.
John J. McCarthy, '52; February 10, 1990; Gloucester, Mass.
Kenneth E. Bowen, '53; August, 1989; Springfield, Ill.
Mason L. Groves, '53; October 13, 1989; Bedford, Mass.
Carl R. Bohne, '54; January 14, 1990; Westford, Mass.
John H. Goncz, '54; December 16, 1989; Falls Church, Va.
Joseph Franklin Tobias, '55; December 19, 1989; Penn Valley, Calif.
Elhanan E. Ronat, '56; October 14, 1989; Rehovot, Israel
Keith J. Stewart, '56; February 12, 1990; Ottawa, Ont., Canada.
Carlyle S. Dewey III, '57; January 27, 1990; Manchester, Conn.
Thomas F. Neal, '59; May, 1989; Pinehurst, N.C.

Jerome I. Sashin, '60; January 6, 1990; Chestnut Hill, Mass.
Richard F. Smith, '60; January 25, 1990; Dallas, Tex.
Robert V. Storer, '60; November, 1988; Bedford, Mass.
Helge Christensen, '61; August 10, 1989; Kongsberg, Norway.
Stephen Angelovich, '62; March 15, 1990; Yonkers, N.Y.
David D. Friesen, '62; April 7, 1990
Mark A. Smith, '64; January 22, 1990; Sharon, Conn.
Bikramjit Roy, '65; 1987
Samuel Jacobs, '69; October 7, 1989; Newport News, Va.
Andrew W. Dawson, '72; January 9, 1990; Belvedere, Calif.
Richard T. Newberg, '72; March 5, 1986; Sudbury, Mass.
David M. Carney, '73; 1985; Cambridge, Mass.
Carol Dees, '74; February 4, 1990; New York, N.Y.
Michael L. Wharton, '84; May 30, 1986; Somerville, Mass.
John McNicholas, '86; November 3, 1989; Calgary, Alberta, Canada.
Georgette L. Redmond, '88; February 23, 1990; Toledo, Ohio



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The name of a deceased MIT alumna or alumnus can be linked to the Institute through gifts made by classmates, colleagues or family. Many donors ask that memorial gifts be unrestricted as to purpose. Contributions also can be made to cancer research, other programs in the life sciences or to any MIT fund. The Institute notifies bereaved families of the name of each donor.

Larger gifts can be used to establish a named endowment fund as a permanent memorial. If you would like information on ways of expressing sympathy through a memorial contribution, or on establishing a named endowment fund, please contact Betsy Millard, MIT Room E38-202, Cambridge, MA 02139 or call (617)253-8059.

An Antepenultimate Adieu

I am sorry to say that I must relate some bad news. A few weeks ago I received a call from Susan Lewis, a senior editor at *Technology Review*, who told me that *TR* would unfortunately have to phase out "Puzzle Corner" by printing no new problems. Apparently, there is pressure for more coverage of MIT affairs and reports about MIT graduates, and at the same time, there are budget and other restrictions on the number of pages in the magazine. As Ms. Lewis accurately stated: If a subscriber wishes to find mathematical puzzles, there are alternative publications; for news about MIT alumni, there is no other source. As a result, *TR* feels compelled to terminate publication of "Puzzle Corner." Ms. Lewis added that the decision was made with a heavy heart and that those involved with the decision realized that many long-time readers of this column have formed a kind of extended family.

Although I am sympathetic with the space problems and cannot argue that there are alternative avenues for presenting alumni news, I am naturally disappointed with having "Puzzle Corner" phased out. The column started 24 years ago in *Tech Engineering News* and has appeared for 23 years in *Technology Review*. I would guess that it is one of the longest running columns in existence and I do feel sorry that I am losing contact with several long-time friends, most of whom I have never had the privilege of meeting.

There will be two issues after this one, at which point answers will have been published for all previously posed problems. I will save my final goodbye for the last column.

Solutions

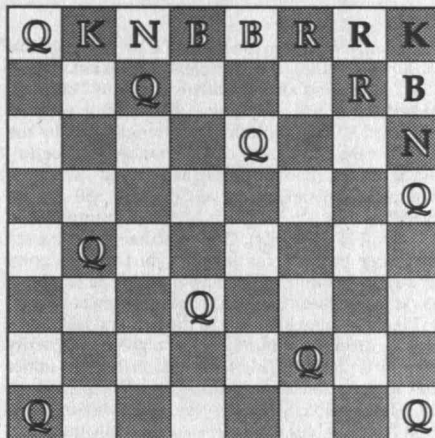
F/M 1. We begin with a newly arrived chess problem from Warner Smith. Find a legal chess position with the largest possible number of successors, i.e., for which the side to move has the largest possible number of moves.

Matthew Fountain sent us a pedestrian chess configuration:



SEND SOLUTIONS AND COMMENTS TO ALLAN J. GOTTLIEB, '67, THE COURANT INSTITUTE, NEW YORK UNIVERSITY, 251 MERCER ST., NEW YORK, N.Y. 10012, OR TO: gottlieb@nyu.edu

Just like in my most recent game with Kasparov, White has 9 queens and 203 legal moves. With all those choices, no wonder I did not pick the right move and let the champ win again.



Also solved by Howard Sard, Steven Feldman, and the proposer.

F/M 2. Jerry Grossman wants you to find two irrational numbers r and s such that r^s is rational and then find two other irrational numbers r and s such that r^s is irrational.

Gerald Leibowitz begins by asserting (the well-known fact) that e is transcendental. Hence, $\ln 2$ is irrational (otherwise, there would be positive integers m and n such that $e^m = 2^n$). But $e^{\ln 2} = 2$ is rational. Also $e^{1+\ln 2} = 2e$ is irrational.

Also solved by Howard Stern, Robert Rorschach, Bob High, Ken Rosato, Gordon Rice, Harry Zarembo, Lyman Hurd, Tom Harriman, Matthew Fountain, and Walter Nissen.

F/M 3. Norman Megill has a cute version of our yearly problem. Although, when you read this problem, it will be 1990, I have kept it as 1989. In formal number theory, there are three primitive operations, + (plus), \times (times), and S (successor or "1 plus"), along with a single primitive number, 0 (zero). Any positive integer can be represented by a combination of 0 and the three operations. For example, 67 can be represented by 0 preceded by 67 S's (68 symbols) or more compactly by S(SSS0 \times SS(SSSS0 \times SSSS0)) (20 symbols), meaning $(1 + (3 \times (1 + 1 + (5 \times 4)))$. Parentheses are excluded when counting symbols. What is the shortest representation for the number 1989?

The following solution is from Bob High (a copy of his program is available from the editor upon request):

Let the minimal length of a representation of n using the successor, addition, and multiplication operations, as defined in this problem, be known as the complexity of n . I wrote a little program to recursively enumerate the complexities of all $n < N$ for a given N . The complexity of 1989 is 34, and the minimal expression is $1989 = SSS0 \times SSS0 \times S(SSSS0 \times SSSS0) \times S(SSS0 \times SSSS0)$, from $1989 = 3 \times 3 \times 17 \times 13$. In examining the resulting table, a number of interesting observations and conjectures arise. For none of the first 10,000 numbers n does the minimal expression involve addition! I conjecture that addition will never appear in a minimal expression.

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Berke concludes that with enough help the maximum moat width can be just under 20 feet but once there are more than 3 or 4 helpers the anchor end of the board gets pretty crowded.

Also solved by Steven Feldman, Bob High, Ken Rosato, Gordon Rice, Lyman Hurd, Avi Ornstein, Roland Roberts, Allan Wiegner, John Woolston, Art Hall, Gwen Yueh, Allan Yueh, Sidney B. Williams, Kelly Woods, Bernie (no last name given), Eugene Sard, Mary Lindenberg, Tom Harriman, Matthew Fountain, Fredric Berger, and the proposer.

F/M 5. Our final regular problem is from that famous riverboat gambler, Gordon Rice. (A) In a gambling game, there are eight balls, numbered 1 through 8, which are shaken up in a jar, and then poured into a funnel leading to a vertical glass tube where they stack on top of each other. Wagers are made, for example, that the 2-ball will be higher in the stack than the 1-ball (even money), or that the 3-ball will be higher than the 2-ball. Another player wants to bet that both things will not happen in a single trial, and offers you 4-to-1 odds. Is this a fair bet? If not, who has the advantage? (B) Unbeknownst to the other players, a cheater succeeds in palming the standard 1-ball and substituting another which is twice as heavy. How should he then bet to take advantage of his trick?

The following solution is from Lyman Hurd: In all these problems balls 4-8 are irrelevant and will be ignored. The sample space consists of six elements and in the fair game the probabilities of each of the six occurrences is 1/6.

First introduce some notation: Denote by E_A the expected return on a unit bet that the 2-ball will be higher than the 1-ball, E_B the expected return on betting that the 3-ball will be

higher than the 2-ball (both bets at even money), and E_C the expected value of betting at 4-to-1 odds that neither happens.

(A) Clearly the even-money bets are fair ($E_A = E_B = 0$). In the case of the third bet, only one of the six possible dispositions of the six balls pays off. The third bet has an expectation $E_C = (1/6)(4) - (5/6)(1) = -1/6$. You should not take him up on his offer (i.e., bet that at least one of the two events will happen. If the odds are adjusted to 5-to-1, the expectation $E'_C = 0$.

(B) The new weighting of the balls clearly has affected the distribution, but sticking to mathematics rather than physics, it is not immediately clear by how much the odds have shifted. What is clear is that the first ball can occupy three positions (relative to the other two) and that they have probabilities $a \leq b \leq c$, where c denotes the probability that the 1-ball is on the bottom, and a that it is on the top. Writing the bottom ball on the right, the relative weights now become:

$P(123) = a/2$	(1)
$P(132) = a/2$	(2)
$P(213) = b/2$	(3)
$P(312) = b/2$	(4)
$P(231) = c/2$	(5)
$P(321) = c/2$	(6)

The cheat clearly has not affected the second bet.

$$E_B = (a/2 + b/2 + c/2)(1) - (a/2 + b/2 + c/2)(1) = 0$$

For the first bet, the new expected value is:

$E_A = (b/2 + c/2)(1) - (b/2 + a/2) = c - a > 0$ which is now favorable. For the third bet the expected value is:

$$E_C = (a/2)(4) - (a/2 + b + c)(1) = (3/2)a - b - c < 0$$

The question is whether it is more favorable to bet that the 2-ball is higher than the 1-ball at even money, or to bet that the 2-ball is higher than the 1-ball or the 3-ball is higher than the 2-ball at 1-4 odds.

It hinges on the relative sizes of E_A and $-E_C$. But

$$E_A - (-E_C) = (c - a) + ((3/2)a - b - c) = a/2 - b < 0$$

Therefore, the greatest advantage is to be had by choosing the advantageous direction on bet C.

Also solved by Bob High, Harry Zarembo, John Woolston, Willy Burke, Tom Harriman, Matthew Fountain, and the proposer.

Better Late Than Never

1989 F/M 3. Forrest Darrough, Jr., suggests using a 1.5-inch-wide saw blade.

N/D 1. Richard Hess has responded.

N/D 2. Richard Hess has responded.

N/D 3. Richard Hess has responded.

N/D 4. Richard Hess and Randall Whitman have responded.

N/D 5. Richard Hess has responded.

1990 JAN 2. Jim Dorsey and Thomas Sico have responded.

JAN 4. Edgar Rose has responded.

AT&T Bell Labs, Bull, GE, Wang, Codex, Prime, MIT, Apollo, Raytheon...

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HOME: Hunts Point, Washington

CAREER: Mr. Barton came to MIT from Newport, New Hampshire, where his attorney father had served as lieutenant governor. With an S.B. in Business and Engineering Administration, which he received in 1939, he went to Seattle to work for The Boeing Company. In 1953-54, he returned to MIT as a Sloan Fellow to earn an S.M. in Management. When he retired in 1984, he was general manager of Boeing International Corporation. Following his father's example in public service, he was the elected mayor of the town of Hunts Point for twenty years, and served on several boards and commissions in the greater Seattle area.

Mr. Barton has been an enthusiastic supporter of MIT for many years. He received the Bronze Beaver in 1971 and, as chairman of his 50th Reunion Gift Committee, led the Class of '39 to a record 82.7% participation and a record class gift. He and his wife Mary have three children and seven grandchildren. This year they are celebrating 50 years of marriage.

GIFT OF CAPITAL: The James W. and Mary Keith Barton Fund in the Maclaurin Pooled Income Fund.

QUOTE: I want to do what I can to strengthen our free society, its churches and great educational institutions, among which MIT has a uniquely important role. The Life Income trust provided a way to give more to MIT than we had thought feasible. In our fiftieth reunion year, 21 classmates thought likewise.

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Science in the Senate

An Interview with Albert Gore, Jr.



Tennessee's
Democratic
junior senator
merges two
personas:
"Mr. Technology"
and
"Mr. Environment."

WHEN Senator Albert Gore, Jr., ran for president in 1988, science stood high on his agenda. Capitalizing on a crowd of early Southern primaries, the Tennessean won seven states. But he couldn't crack the North, and the New York primary, in which the backing of then-mayor Ed Koch was more a bane than a boon,

knocked him out.

In the 101st Congress, although he isn't a scientist, the 42-year-old Gore has been building on his reputation as the science senator. He took over the Science, Technology, and Space Subcommittee chair, a position that *Politics in America* says "allows him to explore the futuristic issues that have long captivated him—and on which he would like to build a political movement."

In Congress and on the national stage, high tech and the environment are pillars of the Gore profile. In his own words, Gore "covers the waterfront" on science and technology, from biotech to global warming, even as he checks out the rent on the White House.

In a Congress weak in intellectual vigor, he comes across as thoughtful and hard-working. For example, the *Almanac of American Politics* notes that Gore studied arms control for months in the early 1980s before adopting the idea of removing multiple warheads from missiles. That proposal won the support of Henry Kissinger, who had backed multiple warheads in the first place. In a 1986 *Technology Review* editorial, Gore pushed the small

mobile "Midgetman" missile as an alternative to the MX.

Though generally a technology advocate, Gore is not a plain-and-simple booster. In the House, he led Science and Investigations Subcommittee hearings on the lack of quality control in the U.S. space program after the Challenger explosion. He has also chaired hearings on human gene therapy, nutrition, and food labels.

As a result, the senator meets ambivalence from high-tech industries. Lisa Raines, legislative director at the Industrial Biotechnology Association, says, "Al Gore has been a friend, but he's been a cautious friend. We're not sure he recognizes how great a role biotechnology can play in improving health care, agriculture, and the economy."

Chairing 1989 Senate hearings on the Human Genome Initiative, Gore said, "Biotechnology has the potential to transform our lives as much as computer technology has." On the one hand, he felt the initiative "will provide spinoffs that could spawn entire new industries." On the other, he continued, "it will also pose challenging new questions about bioethics, technology transfer, international cooperation, and how we organize science."

Gore sees eye to eye with the White House on helping the supercomputer industry. In the current session of Congress, he has introduced a National High Performance Computing Act. Supercomputer research and software would receive the lion's share of almost \$2 billion, doubling present federal spending. To increase access to supercomputers, the legislation envisions a national "data highway," a fiber-optic net-

work linking the machines with leading university and corporate research centers. The bill has pushed the White House to introduce a similar plan.

In a run for the Big Prize, high tech could help Gore raise funds; high visibility on the environment may win votes. Recently, Gore has written and spoken widely about a "Strategic Environmental Initiative" to address the greenhouse effect, prevent future environmental damage, and promote global cooperation. And the 1988-89 winter recess took him to Antarctica and the Amazon rain forest. His ratings by the League of Conservation Voters (LCV) reflect his growing responsiveness to environmental concerns, which he calls a threat to national security. For the 1985-86 Congress, the LCV gave Gore a modest 67 percent grade, which fell to 50 percent in the next session. By contrast, in 1989 he was one of 10 senators to score 100.

Still, even supporters of Gore's ideas—from supercomputers to the environment—worry that many of his proposals leave critical details unaddressed in the search for a political middle ground. Similarly, Gore's military votes sit him in the center, inspiring neither liberals nor conservatives. Although he told TR he is unenthusiastic about Star Wars, he opposed reducing SDI funds in a key 1989 vote, and he supported buying additional B-2 stealth bombers—two "wrong" votes, according to the Americans for Democratic Action (ADA). The American Conservative Union (ACU) gives him a 45 percent rating on SDI.

Up for reelection in Tennessee this year, Gore is practically assured of victory. After that? Recalling John Glenn's 1984 campaign, Science and Government Report notes: "Science as fuel for Presidential ambitions has a poor record, but that may change. . . . With environment and industrial productivity leading the way, sci-tech issues are rising in public notice. Gore may be on to a good thing."

TR editors Sandra Hackman and Marc S. Miller interviewed Gore in his office in March, amidst the rush, bustle, and lobbyists of the new congressional term.

A

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your head.



TR: There's been a lot of debate lately about global warming—whether it is really going to happen and what the effects will really be. Do you think there's enough consensus on the scientific evidence to take major action to halt global warming?

Gore: Yes, I think it's really clear. I think there's a lot of wishful thinking out there and a lot of scientists and politicians engaging in what the psychologists describe with the clinical term "denial." And a lot of folks are just missing the forest for the trees.

I've followed this issue for 23 years. One of my undergraduate professors was Roger Revelle, the man who made the first global measurements of CO₂ in the atmosphere. Back in the middle 1960s, he described for his undergraduates what was happening with CO₂. He showed us how every year the CO₂ graph makes another loop and every year the concentration increases. I've been following this trend ever since. About a dozen years ago, I began to delve far more deeply into it. The overall pattern is, in my mind, very clear.

Let me show you the graph of the Vostok ice-core data on CO₂ from Antarctica (see the table on facing page). [Vostok is a Soviet research base in Antarctica.] They drill down through the ice, get core samples, and read each annual layer the way a forester reads tree rings. They analyze the little air bubbles trapped in the ice and get a highly accurate readout on CO₂. To get the temperature, they look at the ratio between the oxygen isotopes O₁₈ and O₁₆.

The top line of the graph of CO₂ goes back 160,000 years. It shows CO₂ concentrations for the last ice age and the next-to-last ice age, along with the period of warming in between the ice ages. The bottom line is temperature. Now, it looks to my eyes as if there's a relationship between those two lines. That's not a computer model, that's the earth itself. That's what's actually happened. CO₂ has fluctuated between 200 parts per million and 300 parts per million for as far back as we can measure. Temperature has fluctuated in a relatively narrow band but with great

consequences for the earth's climate system. If you live in Cleveland, Ohio, the small difference in global temperature shown on the bottom graph is the difference between having a nice day and having a mile of ice over your head.

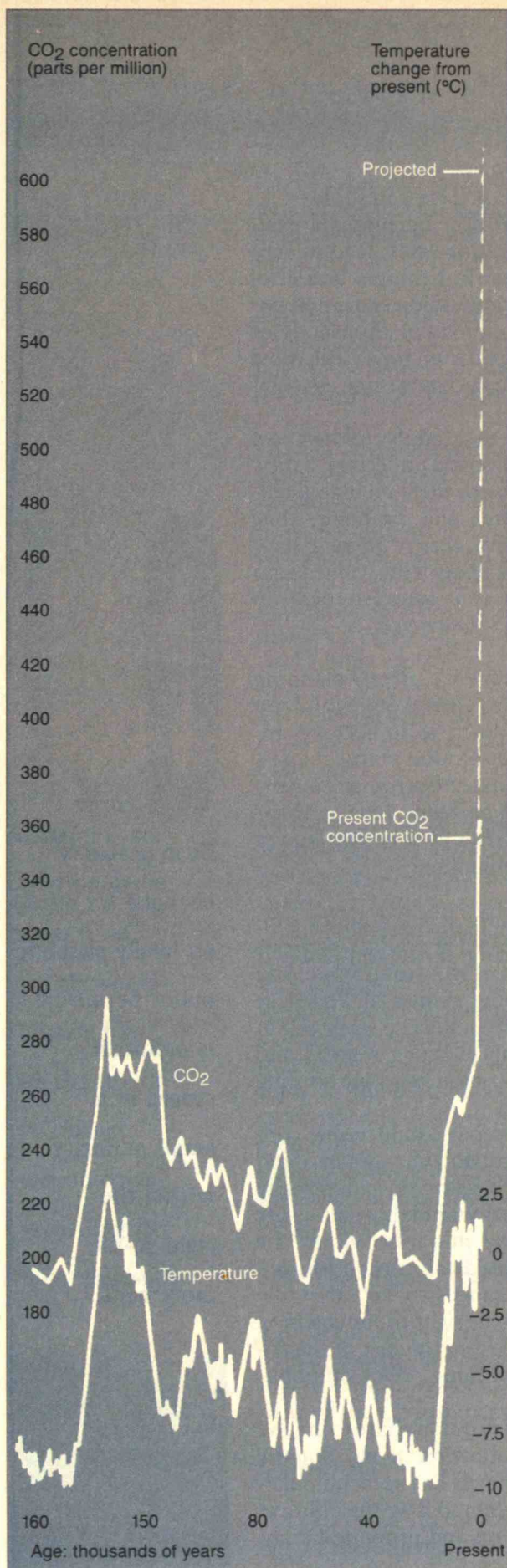
Now here's the point. The computer modeling teams argue about the consequences of a doubling of CO₂. They say the doubling may occur in 37 years, maybe 75 years, somewhere in that time frame. That means CO₂ goes up to 600 parts per million in a few decades. Now for 160,000 years, those lines have moved together. The match isn't perfect—sometimes there's a time lag and other factors involved—but the correlation is striking. The skeptics are essentially saying that even though these two lines have moved together, it's probably okay to take CO₂ up to 600 parts per million or more. They're saying that this temperature line will probably stay flat while CO₂ goes off at a right angle.

I think that's crazy. And I think it's unethical to take CO₂ up to here. And I think it's probably not okay to take CO₂ right through the roof of that graph. What right do we have to take that kind of risk with the earth's climate system? But that's what we're doing.

A Strategic Environmental Initiative

TR: What do you think the federal government should be doing about global warming?

GORE: A lot of things. We should create a consensus for a global population policy targeted at increasing child survival rates and improving education levels, particularly among women. Where children survive and where the women of the society participate in the choice to have children, family sizes come down. Those are the two conditions that are most strongly associated with a demographic transition from high birth rates and high death rates to low birth rates and low death rates—a transition that has taken place in every developed country and in almost no underdeveloped country. We need a global effort to lift the rest



Data from Antarctica suggest that the concentration of carbon dioxide in the atmosphere has paralleled changes in global temperatures for the past 160,000 years. The question is, what will happen to temperatures if carbon dioxide doubles in the next few decades?

of humankind past these thresholds.

In the Third World, high infant mortality and low education levels lead to very large family sizes. In Ethiopia and elsewhere, there's a population explosion going on while hundreds of thousands of young children are dying, because in most of the world there's no such thing as social security.

People rely on their adult children as a source of sustenance and protection in their old age. If they know there's a high likelihood their children will die before they reach the age of five, they're going to have lots of them, particularly if the women who bear them are not empowered to speak up and participate in the choice.

TR: The government's family-planning policy for both the United States and the world is pretty much a do-nothing approach. It revolves around political questions that are separate from recognizing the environment as a problem. Do you think the United States should be doing more to promote family planning?

GORE: We need the kind of policy supported and advocated by young Congressman George Bush of Houston, Texas. And not the do-nothing policy of President George Bush in 1990. Reagan slashed U.S. programs for family planning overseas, and the Bush administration has done nothing to restore them.

An objective observer would have to conclude that Bush probably changed his mind on this question because he is politically scared of a minority within the right-to-life movement. A tiny minority within the movement is opposed to birth control, and that minority manages to fuzz over the differences within the right-to-life coalition and gain support from the rest of the coalition for a do-nothing policy on population.

Population policy doesn't have to involve the question of abortion at all. But the president unfortunately has been intimidated and does not seem to have the political courage to stand up and promote family planning.

G eorge
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movement.**



TR: To take one example, should the United States resume its contributions to the U.N.'s family-planning efforts?

GORE: That's what I mean. Bush is scared to do that—even though he used to support that—when he had time to really think about it.

But let me add one thing. We think of population policy as family planning, information, and devices. While that is necessary and a precondition for success, I'm arguing that really we need to take a much bolder approach. We need a kind of global Marshall Plan, with Japanese and European capital helping to fuel the plan, to lift child-survival rates and education levels up to the threshold where the demographic transition takes place.

TR: How else can the government attack global warming and other environmental threats?

GORE: We should accelerate the development of new, more benign technologies that can substitute for some of those now causing so much damage, and disseminate them as quickly as possible. We should ban certain chemicals almost immediately—chlorofluorocarbons, hydrochlorofluorocarbons, halons, bromines, etc.—that are ozone depleters as well as greenhouse gases. We should develop a global strategy to halt deforestation and begin massive reforestation all over the earth. We should institute a CO₂ tax and a virgin-materials fee—use the market system to send accurate signals about the true cost of the choices we make. And we should enter into negotiations for a new generation of global climate agreements that can accomplish our purposes.

Now, those and other actions seem to be outside the scope of what is politically attainable in the world. A scientist friend of mine who's worked on these issues for years said the other day, "Al, don't you think it's unlikely that we'll be able to do all that?" And my answer was, "What if I'd asked you six months ago whether or not it's likely that in the next few months every single country in Eastern Europe would throw off

communism and embrace democracy? Would you have said that was unlikely?" And he said yes. What made that suddenly possible was a change in the pattern of thinking about communism. I think we are right now undergoing a change in the pattern of humankind's thinking about the global environment, which will soon result in a significant expansion of the realm of what is the possible by way of responses.

People are beginning to experience the global environment as part of their backyard. Just to take one example, the air we're breathing right now has 600 percent more chlorine atoms per lungful than it did 40 years ago—or a billion years ago. And that's due to one family of chemicals used just since 1950, the chlorofluorocarbons. The fact that we can make that kind of change in the atmosphere of the entire globe in just 40 years should be sobering and should lead us to look more closely at the other dramatic changes we're causing in the global atmosphere.

TR: Are you advocating that the U.S. government do more to develop and promote alternative-energy technology?

GORE: Yes.

TR: In other words, the government should depart from the environmental and energy policies of the last 10 years?

GORE: I've proposed a Strategic Environmental Initiative to focus as intently as the Strategic Defense Initiative on the new technologies we need in transportation, manufacturing, agriculture, and every vital source of commercial activity. I didn't happen to be very enthusiastic about SDI, but I admired the level of energy and organization and resources put into SDI. We need comparable levels of support for an SEI—in fact, even greater levels of support. We need centers of environmental training in the Third World where these new technologies can be mastered and disseminated.

TR: What about in the United States?

GORE: And here, sure. But hopefully we'll develop the technologies and find markets as the world moves away from the technologies that are so harmful today.

TR: Yet the federal government hasn't been willing to fund that in the last decade. It has moved away from any kind of support for solar energy or other alternatives.

GORE: Yes, soon we may have to import renewable-energy technology from Japan and Europe. Over the last nine years, we have withdrawn from the alternative-energy field, while the Japanese have stepped up their investments. And they're now positioned to dominate some of that market. There's still time for us to change. And I hope we will.

TR: As you say, SEI will be very costly, more expensive than SDI. How will it be financed?

GORE: I've called for an environmental security trust fund, which would impose fees on the use of polluting technologies according to their emissions. The fund would provide subsidies out of that revenue for the development and purchase of more benign technologies. The trust fund could be used to subsidize those technologies still in the developmental stage and to purchase those that society wishes to encourage as substitutes. It would be analogous to the social security trust fund, which receives payments from people who are working and makes payments to those who need help at the stage of their lives when they are no longer working.

Supercomputing: The High-Tech Road

TR: In Congress you are a leading proponent of high technology. To some people, that would contradict your role as a proponent of the environment.

GORE: Why?

TR: According to the stereotype, technology is associated with economic develop-

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ment, which tends to lead to environmental destruction. You have to choose.

GORE: Why?

TR: You build a car, its emissions pollute the air.

GORE: You build a better car, and it doesn't.

Technologies are tools. And if you ignore the cost to the environment of using a particular technology, then you're not making a good choice in the technology you pick. But technology itself is not hostile to the environment.

Wendell Berry, one of the "theologians" of the environmental movement, describes the agricultural technology of the Amish for terracing their hillside farms and planting winter cover crops alongside grain crops according to a scientifically designed rotation. That's a technology that prevents soil erosion and maximizes food production. On the other hand, plowing fence row to fence row, spraying on 900 percent more pesticides than could possibly be justified for pest control, and using fertilizer until the ground is bleached of its essential nutrients, poisoning the groundwater in the process—that, too, is a technology; it just happens to be a pretty bad one. So given the choice between those two technologies, one doesn't have to say technology itself is antithetical to the environment.

TR: The choices also involve money. Both you and the administration are advocating a supercomputer program that would include funds for hardware, software, and an advanced National Research and Education Network. The price tag could reach \$2 billion. If the United States couldn't fund both the supercomputer proposals and a Strategic Environmental Initiative, which would you put first?

GORE: It's not as if they are inconsistent or represent an either/or choice. They go together. Supercomputers will be one of the principal technologies we must use to develop a more comprehensive understand-

We

will

have what one

scientist has

called a

graphic jam.

We're on the

seventh-generation

supercomputer

now, but we're

still on only the

second-generation

network.



ing of how we can heal the global environment. In fact, analysis of global climate change is the cutting-edge task for information processing, pushing the envelope of computer capacity.

TR: Do you see a conflict between your proposed National High-Performance Computing Act, which is based on competition with a lot of other countries, and the environmental initiative, which would be built on cooperation with the rest of the world?

GORE: Well, no, I think we will enhance our competitive strength by becoming the first to develop more environmentally benign technologies, because we'll be able to sell those technologies in the rest of the world. So I think that's a competitiveness issue as well. It's of course primarily an issue of survival.

TR: Many people think there's more commercial effect from the lower end of computers than from supercomputers. Why should the federal government target the supercomputer industry as opposed to computers for industrial applications or, say, high-definition television, which has more advocates in Congress?

GORE: There's a chicken-and-egg problem with supercomputers. You have a range of functions that become possible only with very high data flows. Yet people in businesses and universities are reluctant to get into those new functions if they have to purchase a machine themselves, and if they can't communicate easily with those who are working on the same kinds of problems. Nobody in the private sector wants to build the network to make supercomputers more widely available until the demand is there, and the demand won't develop until the network is there. The government can help lift the country past that hurdle with seed money to put the network in place, and then a transition can take place into the private sector as soon as that's feasible.

I believe that the existence of this network will lead to new uses for supercom-

puters, new services, new businesses as yet undreamed of. The machines that cost 15 to 20 million dollars now will cost four or five hundred thousand dollars within five years. We will have what one scientist has called a graphic jam, an inability to transmit visual images from one computer to another, an inability for teams separated geographically to work in concert. We're on the seventh-generation supercomputer now, but we're still on only the second-generation network.

In any event, information is now an essential feature of what we used to call infrastructure. The problem is that people think about infrastructure only in terms of nineteenth-century technology—water lines, sewer lines, roads, bridges. We need to think about it in terms of twentieth- and twenty-first-century technology. The infrastructure of our nation must include the information infrastructure. And if we build the National Research and Education Network (NREN), we'll be far more able to compete. The president's science advisor, Dr. Allan Bromley, said this is the most cost-effective investment this country can make in terms of competitiveness, in terms of science and technology. And I agree.

TR: Even supporters of the supercomputer bill say that both you and the administration are proposing a Cadillac—a network of use mainly to scientific researchers. Does the bill plan for the time when this network could reach into homes?

GORE: People are already starting to plan for that, even as this national network legislation is about to be passed. When the interstate highway system was built, state governments and local governments quickly added feeder lines to make maximum use of it. Then localities quickly added bypasses and trunk lines to extend access from the smallest town to the interstate highway system. The same thing will take place with this network, and what some might call a Cadillac today will be a Yugo tomorrow.

You know, fiber is a very interesting technology. It's the first information-transmission technology where huge in-

creases in capacity do not require additional lines to be laid down across the surface of the earth. You add new switches, new electronics, and you can vastly upgrade the capacity of existing fiber-optic cables. And so the same innovations that make the network possible will make it possible to extend it into every nook and cranny where there's a threshold level of demand for information services.

I've also been associated with a proposal to allow—with safeguards—the telephone industry to get into the cable-television business. If you're really interested in getting fiber into the home, that is the quickest way to do it.

TR: Several companies, like MCI and Sprint, have already installed fiber-optic networks. Couldn't they take on a project like this on their own, rather than have the federal government fund an entirely new network?

GORE: MCI and the others support my bill. It's designed to be compatible with the existing fiber-optic networks. And indeed as we push the state of technology to create the national network, the other smaller networks will find it possible to quickly add new capacity. Most of the traffic on the NREN will be carried on fiber-optic lines belonging to the private sector.

Science Policy and Government

TR: What isn't Congress doing that it could be in setting science policy?

GORE: In the Congress, we have barely begun to scratch the surface on science policy. I've tried to cover the waterfront, and intend to continue focusing on selected parts of the whole, but we've got a lot of work to do.

It isn't easy, since more than half a dozen congressional committees set science and technology policy. I chair the Science, Technology, and Space Subcommittee, but there's also the Armed Services Committee, the Environment and Public Works Committee. And of course, there's the Ap-

F or
too many years,
the Office of
Science and
Technology Policy
suffered a kind of
malaise caused by
a lack of
funding and a
lack of access to
the president.
I'm glad to see
that changing.



appropriations Committee that signs the checks.

Despite all the different players, you see a lot more teamwork on science issues than you do in most other areas. Science issues tend to be less ideological and more bipartisan. We're lucky that way.

My supercomputer bill involves four agencies—NASA, NSF, the Defense Advanced Research Projects Agency, and the Energy Department—and three different Senate committees. Each committee is working on its part, the part done by the agencies under its jurisdiction. It's not easy to work this way; it represents a lot of coordination and communication. But it is working, and I think it can serve as a model for other such R&D programs.

TR: How do you think President Bush and his science advisor are doing in technology policy? How does their performance compare with that of the previous decade?

GORE: I think Dr. Bromley is making policy coordination much easier. As director of the Office of Science and Technology Policy (OSTP), he's in charge of coordinating the administration's science policy, and I think he's doing a great job. He's become *the* administration's spokesman on science. I hope he becomes the C. Everett Koop of science.

Dr. Bromley is a refreshing change. For too many years, OSTP suffered a kind of malaise—a malaise caused by a lack of funding and a lack of access to the president. I'm glad to see that changing. And I'm very glad to see Dr. Bromley and others at OSTP communicating with the Congress

We
**need more
technically
trained
Americans
helping shape
government
policy, running
businesses, and
even running
for Congress.**



both formally and informally.

Dr. Bromley knows how to listen, and that's critical if he's going to build support for the administration's science programs in Congress. With Dr. Bromley, I think we'll see a more coherent national science and technology policy, one that will be developed and implemented in a bipartisan manner.

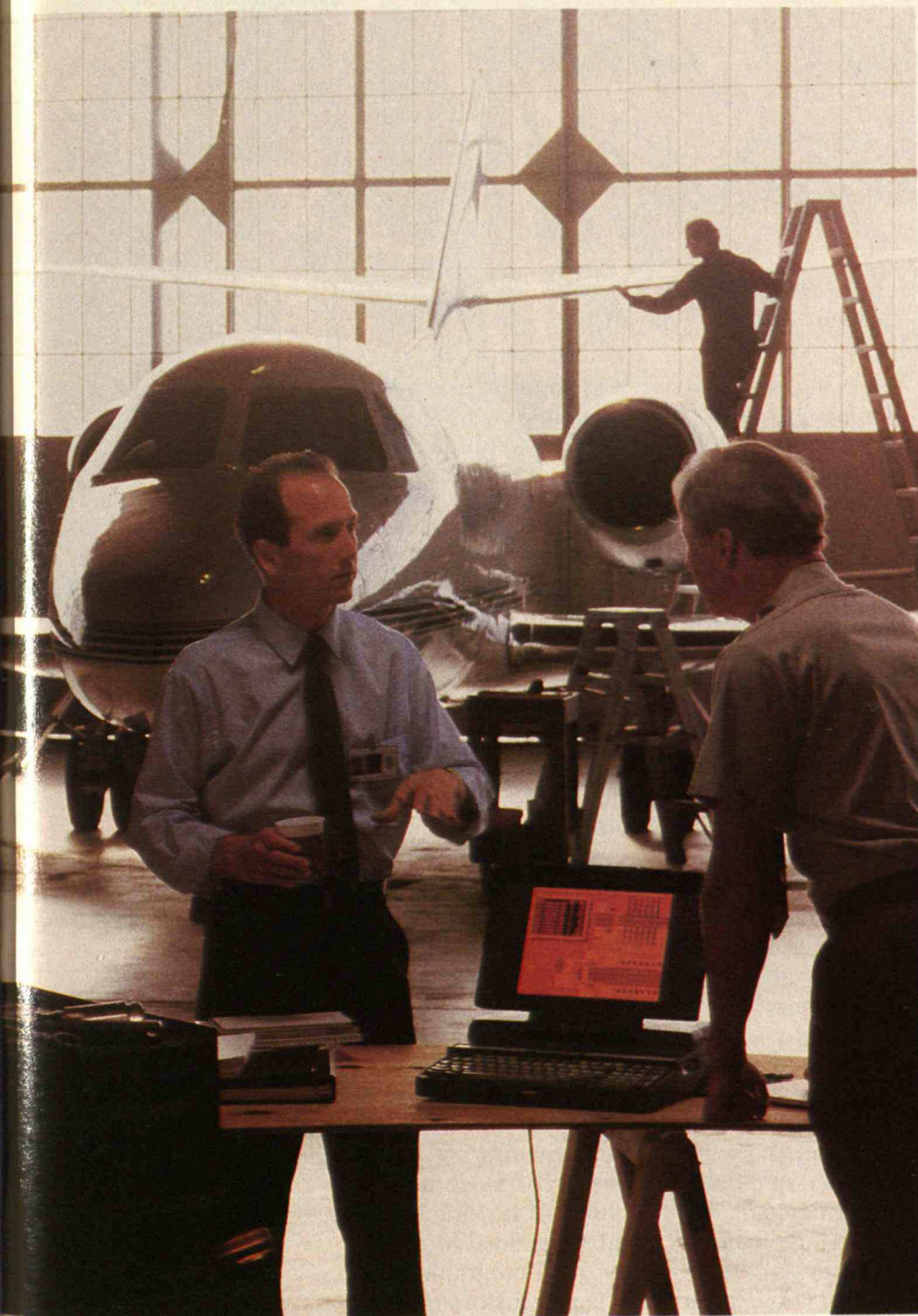
TR: How do you see scientists and technologists contributing to the important issues of the coming decade?

GORE: I guess the short answer is: not enough. I'm very concerned about projections showing an acute shortage of scientists and engineers by the year 2000. At almost every hearing the Science Subcommittee holds, the issue of manpower comes up. Whether the hearing is about the space station, global-change research, or supercomputing, there always seems to be a question of whether we'll have the scientists and engineers needed to do the work.

But there's a broader question here as well. We need more scientists and engineers in other capacities than just R&D. Not all lawyers practice law. They run companies; they serve in Congress. We don't expect lawyers to stay in the courtroom, why do we expect scientists to stay in the lab?

One of the secrets of the Japanese success is the number of scientists and engineers in the upper ranks of government and industry. It's clear to me that we need more technically trained Americans helping shape government policy, running businesses, and even running for Congress. ■

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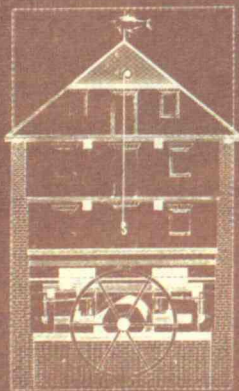
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Saving U.S. Industry *in Words and Pictures*

By DAVID BRITTAN

*The Historic
American
Engineering
Record
wants future
generations to
appreciate
their
technological
heritage.*

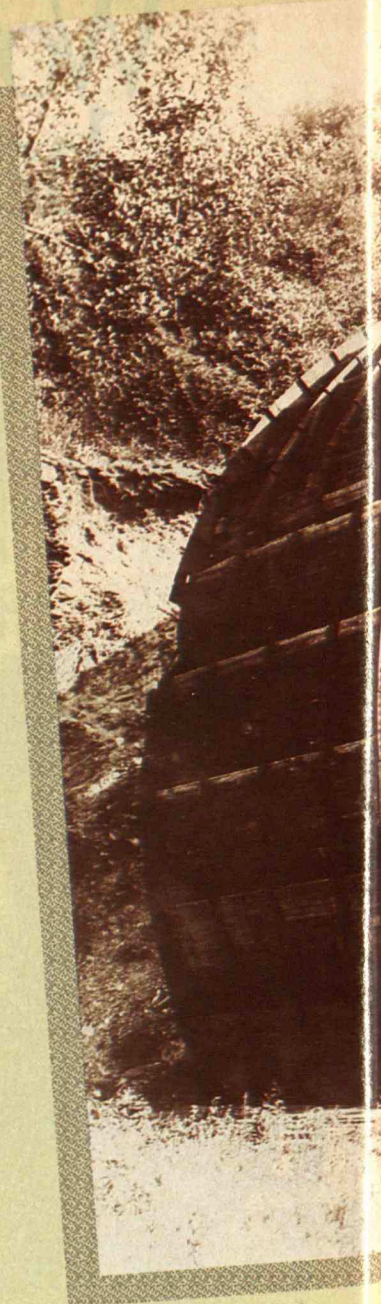


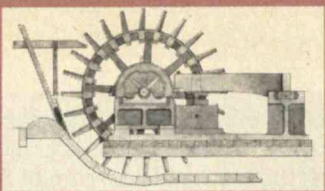
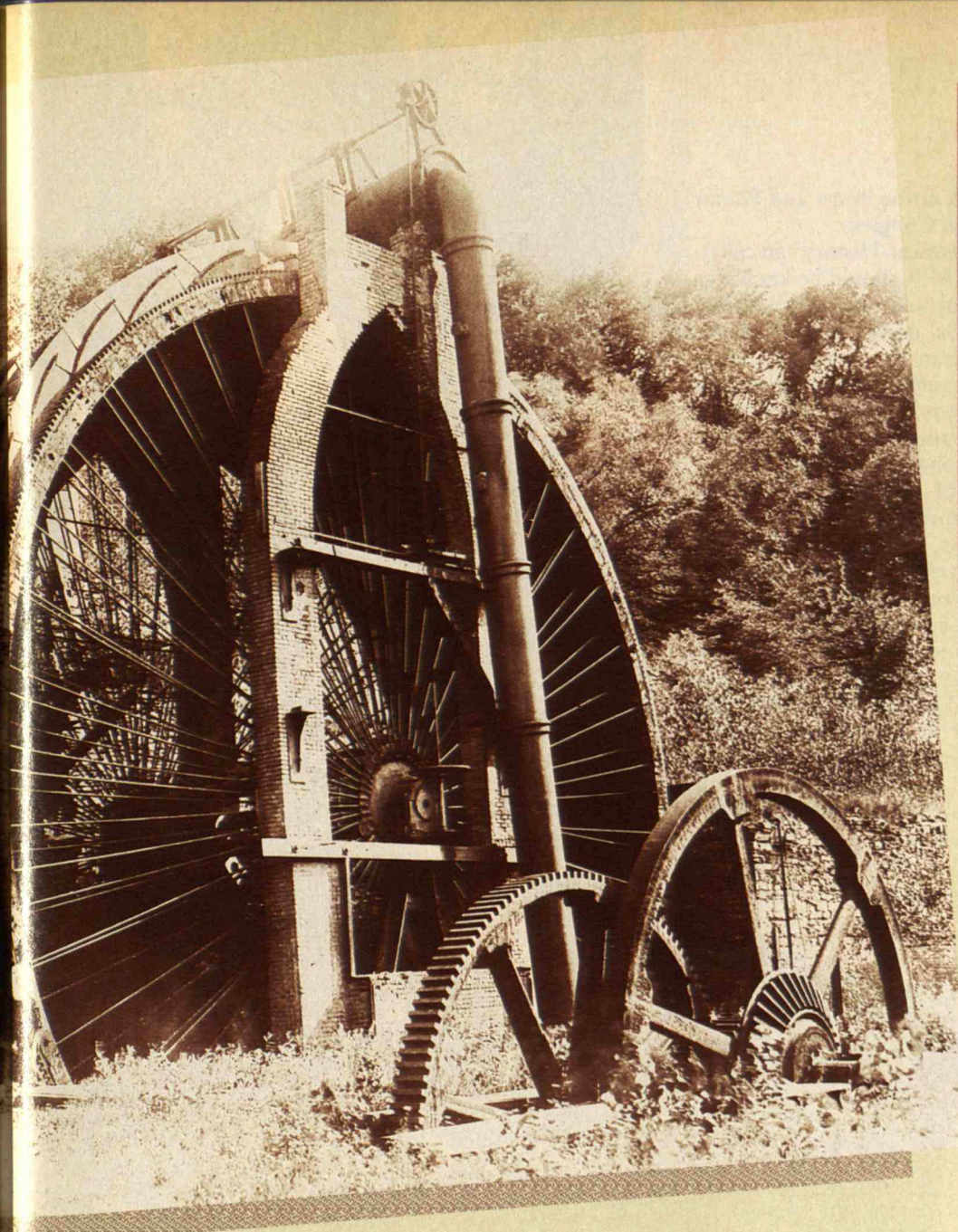
THE clang of steel no longer resounds across the Homestead Works in Munhall Borough, Pa. For a hundred years the plant churned out armor plate, winning a coveted Russian naval contract in 1894, helping build up the U.S. Navy under President Theodore Roosevelt, and supplying the nation's war effort in the 1940s.

The Homestead Works was also the scene of an infamous labor dispute in the days when it belonged to Carnegie Steel. In 1892, when union workers struck over wage cuts, the plant manager hired 300 Pinkerton detectives to protect property and strikebreakers. Violence ensued, leaving 14 dead and 163 injured. The National Guard marched in, non-union labor stayed, and the Amalgamated Association of Iron and Steel Workers never recovered. U.S. Steel, the owner since 1901, closed the plant in 1985.

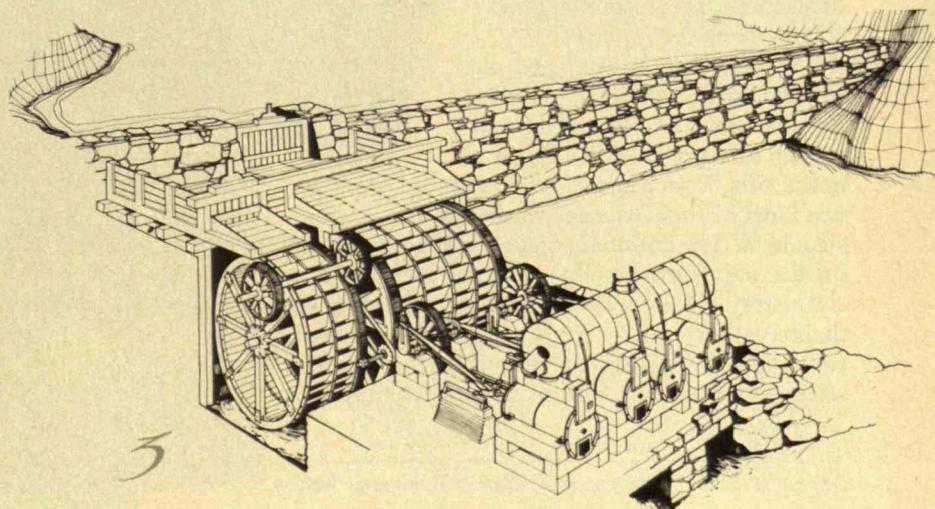
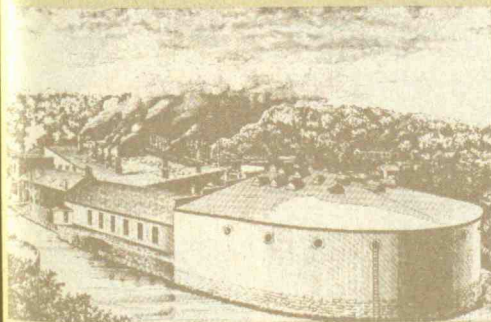
Today, the Homestead Works is gradually being torn down, cut up, and sold for scrap. Even if a local preservation group succeeds in founding a steel-industry museum there, most of the plant's historic structures will soon be gone.

But not forgotten. The Homestead Works is among the 2,000 or so structures and objects that have been documented by the Historic American Engineering Record, a division of the National Park Service. HAER does for engineering what its sister organization, the Historic American Buildings Survey (HABS), does for architecture: it scouts out structures of historic significance, giving preference to those destined for the wrecking ball, and hires teams of photographers, professors, and student architects and historians to record them for posterity. For over a year, a team at the Homestead Works has been busy compiling written histories and descriptions, old and modern photos, and measured drawings of structures, machines, and processes. These records then enter a permanent col-





From the HAER collection: (1) A water wheel at (2) the Burden Iron Co., Troy, N.Y. The wheel was photographed around 1900, shortly after it was removed from service. The size of the man suggests its massive scale. (3) A HAER reconstruction drawing of water wheels driving blast machinery at Adirondack Iron and Steel, Tabawus, N.Y.



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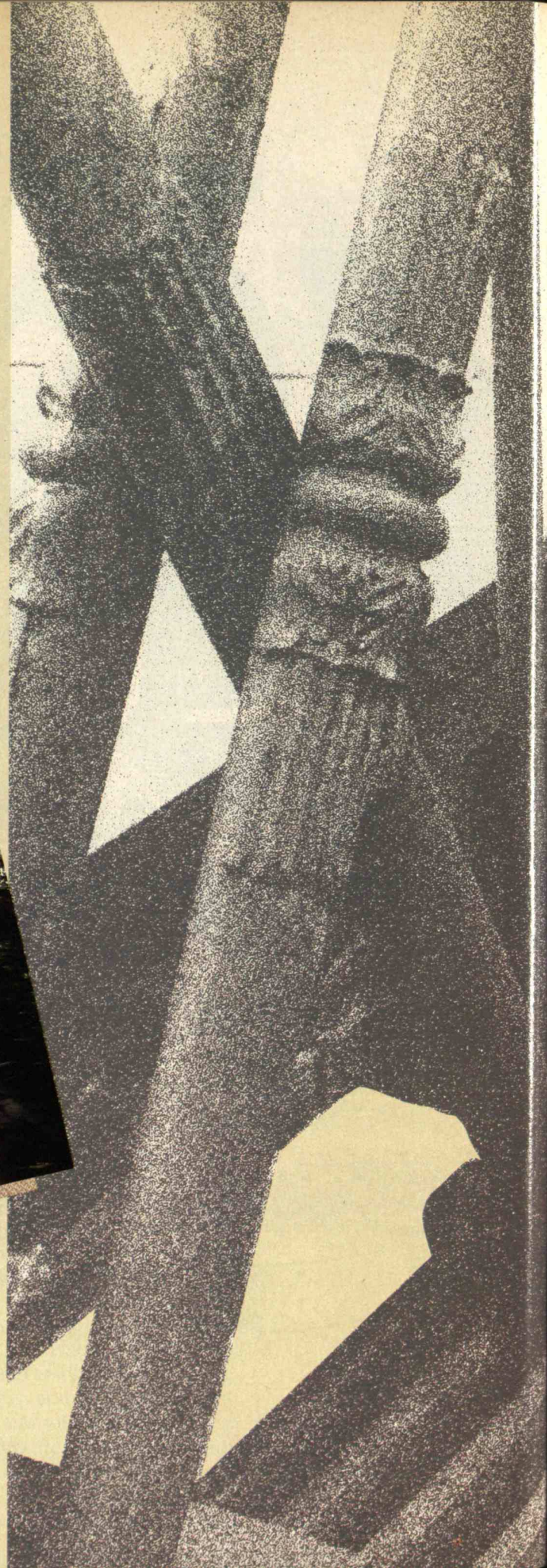
If the National Museum of American History can call itself "America's attic," perhaps HAER should be known as "America's toolshed." Its files include blacksmith shops, bridges, canals, cider presses, coal mines, culverts, dams, electric power plants, foundries, granaries, ironworks, kilns, lighthouses, privies, sewage treatment plants, schooners, subways, tanneries, tunnels, viaducts, and waterworks—any invention or structure that has been important to the development of a region or of a branch of engineering. HAER teams have traveled most of the length of the B&O and Erie railroads, recording every major structure and object. They have evaluated historic U.S. Army sites, such as the V-2 launch facility at White Sands, N.M. They have even documented an engineering relic of the 1960s and '70s: the towering gantries of the Apollo program at Cape Canaveral.

HAER's coverage has been biased toward the East, partly because it was the seat of the Industrial Revolution and partly because the organization is based in Washington, D.C. But some changes are in the works. HAER is trying to interest mining companies and state agencies in sponsoring an effort to document western mining—gold, silver, and hardrock. (Although congressional funding pays HAER's administrative costs, the organization relies on outside sponsors to cover field costs.) It is also casting an eye toward midwestern industrial cities like Wichita, Kansas City, and Milwaukee.

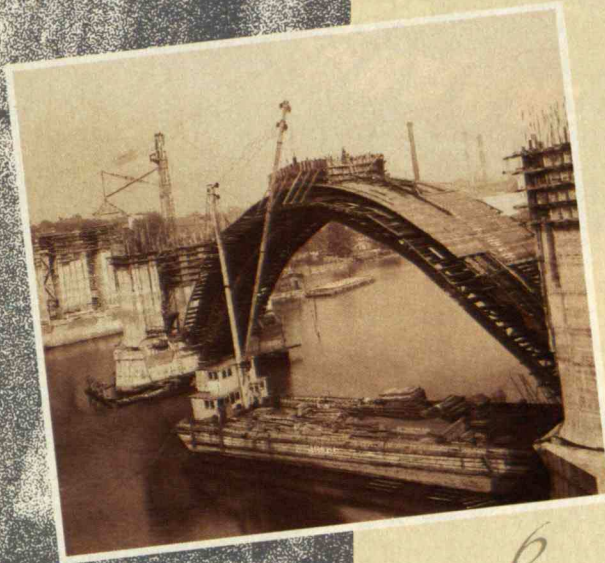
Why Bother?

A cynic could say the desire to immortalize old culverts, tanneries, and the like is sheer sentimentality. But the motivation behind HAER runs much deeper than an attachment to artifacts. Humble or inelegant as some of these structures may seem, HAER's staff considers them important evidence of the processes that have shaped American society.

The organization developed out of what HABS/HAER chief Robert Kapsch calls a "bottom-up" approach to history. "When I grew up, in the '50s," says Kapsch, "all history was DAR history—'George Washington slept here.' The dominant history was political, diplomatic, intellectual. With the '60s, the dominant history became social history. Historians began looking at everyday objects and their significance in people's lives." If technology is not just something that trickles down from science but a product of science, capital, and culture combined, he says, then an en-



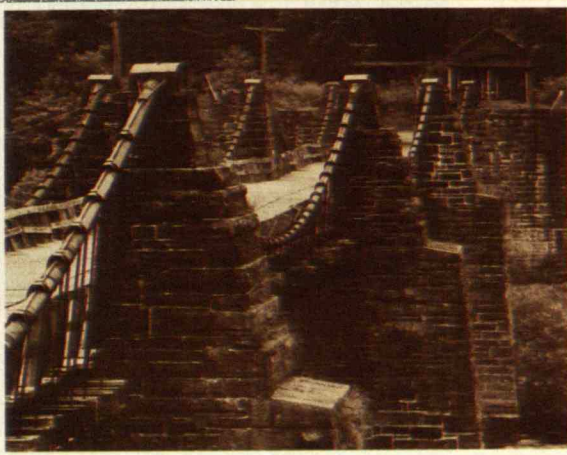
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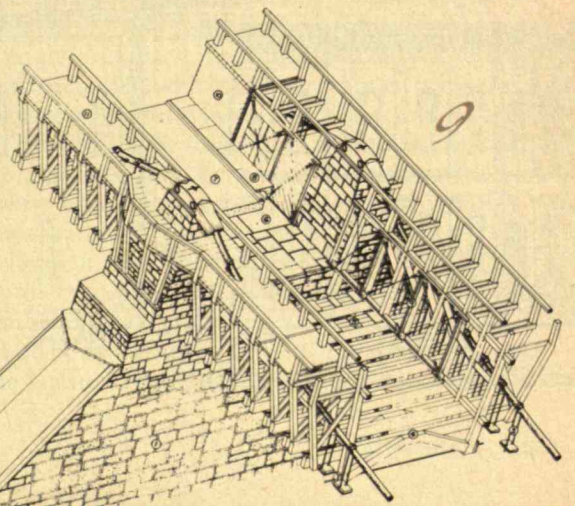
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(4) A HAER team measuring the oldest bridge in Arkansas, the 1871 Springfield Bridge, prefabricated by King Iron Bridge Works, Iola, Kans. (5) A close-up of Egyptian-revival detailing on the country's second-oldest all-iron railroad bridge, the 1846 Reading-Halls Station Bridge, Lycoming County, Pa. (6) The Key Bridge, Washington, D.C., under construction around 1920. (7) The Million Dollar Bridge, built in 1912 at Cordova, Alaska, as part of a railway line to the copper mines of Kennecott. The left span collapsed during the 1964 Alaskan earthquake. (8) The Delaware Aqueduct, spanning Lackawaxen, Pa., and Minisink Ford, N.Y. Built in the 1840s by Brooklyn Bridge designer John Roebling, it is considered the country's oldest suspension bridge. (9) A HAER drawing of part of the Delaware Aqueduct, reconstructing the tow-paths for mules and the channel through which they pulled coal-laden boats. The National Park Service is restoring the bridge to this state.



(10) New York City's last remaining fire-watch tower, in Marcus Garvey Park, Harlem. Erected in 1856, it became obsolete in 20 years with the introduction of telegraph alarm boxes. (11) A Good-year blimp airdock near Akron, Ohio. Built as a factory for zeppelins (rigid airships) in 1929, it is 1,175 feet long, 325 feet wide, and 211 feet high. (12) An 1873 gasholder house in Troy, N.Y. Gaslight companies used such structures to protect iron tanks containing coal gas. The upper half of the tank would telescope into the lower half, forcing gas out through pipes to customers. This building is now a warehouse and garage. (13) A detail of the Troy gasholder house, showing one of the trusses that support the cupola and a guide rail for the rising and falling tank. (14) The mill complex and copper-mining camp of the Kennecott Mining Co., Kennecott, Alaska. The mines closed in 1938.

gineering site can say a lot about the society that created it. "Our starting point is material culture: we start with the object."

The objects that Eric DeLony, chief of HAER, most enjoys contemplating are historic bridges, on which he is a leading authority. A simple question about metal trusses unleashes a monologue of waxing intensity, in which DeLony seems to be mentally traveling back in time:

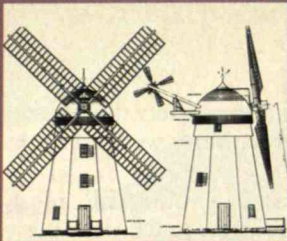
"I'm interested in metal-truss bridges partly because they were a phenomenon of mass production. These bridges were being thrown up by the hundreds all over the United States in the latter part of the nineteenth century. Bridge company representatives out there in Omaha, Kansas City, San Antonio, Minneapolis-St. Paul were hawking their company's product to try and convince county commissioners and town engineers that theirs is better than the competitor's down the road. Then that structure is fabricated in Cleveland or Canton, Ohio, and transported a thousand miles to the wilds of Wyoming. It's received at the other end by the company representative. He's had to organize a work crew there to offload the bridge from the railroad car and put it on wagons, take it out to some godforsaken little stream, and have the abutments in place, with the crew ready to go to work.

"And then you have to understand what was involved in the patents. Thousands of them were taken out on truss bridges in the latter part of the nineteenth century. Researching those patents, the entrepreneurs, the engineers—the whole process of bridge building—tells us an awful lot about the way this country developed, the way we worked, the way we engineered."

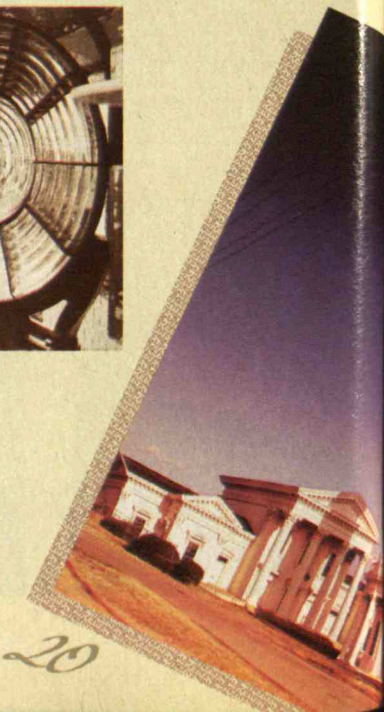
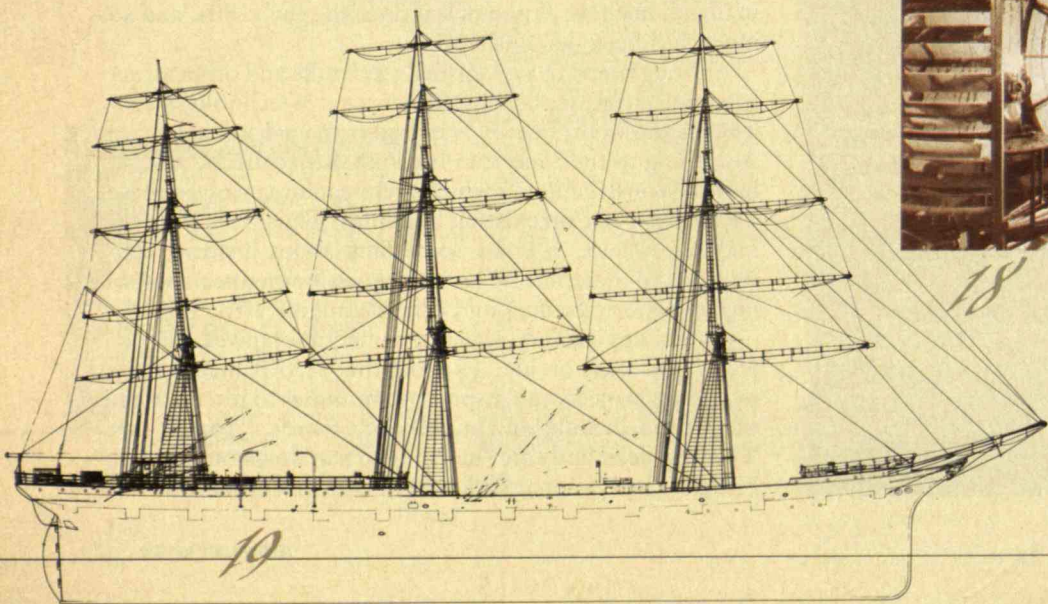
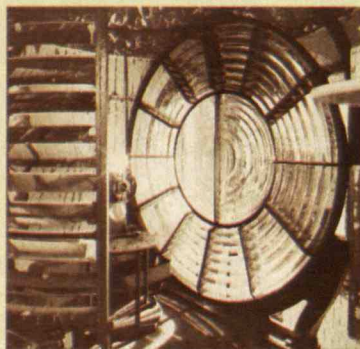
HAER is driven not only by the emergence of this bottom-up style of history but also by the steady disappearance of the objects on which that history hangs. One threat is the upgrading of the nation's infrastructure. "The monuments—the Golden Gate Bridge, the Brooklyn Bridge—are going to take care of themselves," says DeLony. "But the ubiquitous metal truss that may be 70, 80, or 100 years old—those are the ones that we're losing." The decline of basic industries like mining and steel adds to the time pressure. Gray Fitzsimons leads HAER's year-old effort to document the remains of the U.S. iron and steel industry. "Unfortunately," he says, "in some ways we're about 10 years too late. So many plants have closed down since the early '80s, and so much has been demolished."

Although records of vanished steel mills and other structures are of obvious benefit to historians of technology, economics, or labor, HAER is not just an academic exercise. According to the American Institute of Architects, at least half the construction in which architects are involved these days takes place on existing buildings. Thus, says Kapsch, architects "have to know something about historic techniques and materials." The same goes for engineers working on historic bridges and other aging infrastructure.

Sometimes the very act of documentation gives the subject a new lease on life. The fuss that HAER makes in its recording projects can inspire communities to rescue structures from demolition. In DeLony's words, "They'll say: 'Over my dead body are you going to tear down our historic bridge. The National Park Service Historic American En-



(15) Long Island's 1820 Beebe Windmill, formerly of Sag Harbor, now of Southampton. It incorporated several British innovations, including (16) a "fantail" to direct the sails into the wind and (17) cast-iron gears instead of wooden ones. (18) The interior of the 1876 Liston Range Rear Light, Biddles Corner, Del., showing the reflector, lens, and modern lamp changer. When this lighthouse is aligned with another, lower one, navigators on the Delaware River know that they are on a safe course through the channel. (19) The Balclutha, a steel-hulled deepwaterman launched near Glasgow, Scotland, in 1886. Retired in 1930, it is now preserved at the National Maritime Museum, San Francisco. (20) An 1856 Louisville (Ky.) Water Co. pumping station where form swallows function.



gineering Record was here, and they measured it and documented it. We want to keep it.' That's what is really exciting about this work."

If Walls Could Speak

Rummaging through the HAER collection, one can easily see why people like DeLony are so keen on preserving all this old stuff, whether on paper or *in situ*. Each machine or structure—irrelevant as it may seem today—once served a useful purpose. And each has a unique history. HAER historians delve into patent records, professional journals, engineering treatises, newspapers, correspondence, corporate records, and other sources to uncover the stories behind those objects. Here are a few of them:

THE BEEBE WINDMILL.

In the days before other forms of energy took over the task of grinding grain, Long Island was dotted with windmills. The mills built there before the early nineteenth century were a lot less advanced than those across the Atlantic. But in 1820, after studying English-style windmills that had sprung up in Manhattan, Samuel Schellinger imported some of the new technology to the Long Island town of Sag Harbor.

In the windmill he built that year for Captain Lester Beebe, Schellinger substituted cast-iron gearing for wood and incorporated centrifugal governors to keep the upper and lower grinding stones the proper distance apart. Another innovation was a fly, or fantail, opposite the four sails on the mill's revolving cap. In a breeze, the fly would act like a weather vane, automatically keeping the sails pointed into the wind. The Beebe Windmill also had the advantage of height. With each revolution, its 32-foot sails generated enough power to turn the grinding stones twice as fast as another, more typical Long Island windmill that had sails 23 feet long. As a result, the Beebe Windmill could produce flour on days too calm for lesser mills.

ALLIED TEXTILE PRINTERS.

The Paterson, N.J., factory building now owned by Allied Textile Printers is a monument to nineteenth-century entrepreneurship. Built in 1836 on a site once occupied by a nail factory, it produced the first Colt revolver and the first Mason radiator. It's also a landmark in the history of silk processing.

The concern that built the plant was the Patent Arms Manufacturing Co., organized by prominent New York financiers to manufacture Samuel Colt's newly patented weapon. (Accordingly, the factory was decked out in an arms motif, with the spire of the belltower and each picket of the surrounding fence shaped like a gun.) In 1838, Samuel Colt's brother Christopher tried to set up a silk mill on the fourth floor of the gun factory, but decided after processing a single bale of raw silk that the enterprise would not be profitable. Two years later, however, two other entrepreneurs—George Murray

and John Ryle—took over the space and set up a successful silk business. They are believed to have spun the country's first skein of sewing silk.

As Murray and Ryle were piling up silk, the Patent Arms Co. was piling up debt. The business was seized by creditors in 1842—but not before its owners had hidden \$60,000 worth of equipment beneath piles of coal.

Over the next few decades, several cotton manufacturers occupied part of the building, and in 1875 Joshua Mason moved his machine shop in. It was here that he developed his famous steam-heat radiator. Since then, the building has been occupied mainly by textile manufacturers.

THE DELAWARE AQUEDUCT.

Civil engineer John Roebling's last and most famous creation was the Brooklyn Bridge. But his earliest surviving work is an aqueduct on the Delaware & Hudson Canal. It's also thought to be the country's oldest suspension bridge that retains most of its original structure.

The D&H Canal, opened in 1829, was built with a single aim: to transport anthracitic coal. Mule-drawn boats would carry their 20-ton loads in 4½ feet of water from coal fields in northeastern Pennsylvania to the Hudson River, a distance of 108 miles. The cargo would then be transferred to other boats and floated down the river to New York City.

Facing competition from the Erie Railroad, the D&H directors decided in the 1840s to increase the canal's efficiency and capacity. Among other measures, they hired Roebling to relieve congestion at the intersection with the Delaware by building an aqueduct that would carry the canal *over* the river instead of through it. His design, a cable suspension bridge of four spans, beat out another proposal for a trussed timber structure of six spans. Requiring two fewer piers, it promised less disruption to the flow of water, ice, and traffic in the river below.

Roebling used his own method for making and anchoring the cables—a technique still employed for major suspension bridges. Each 8½-inch cable consists of 2,150 iron wires, which were strung up individually and formed into seven strands. A coating of varnish and oil protected the cable from weather.

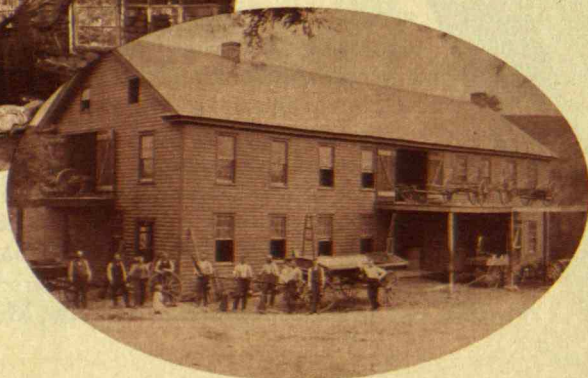
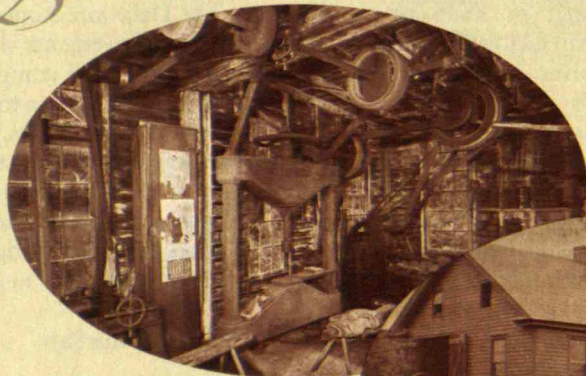
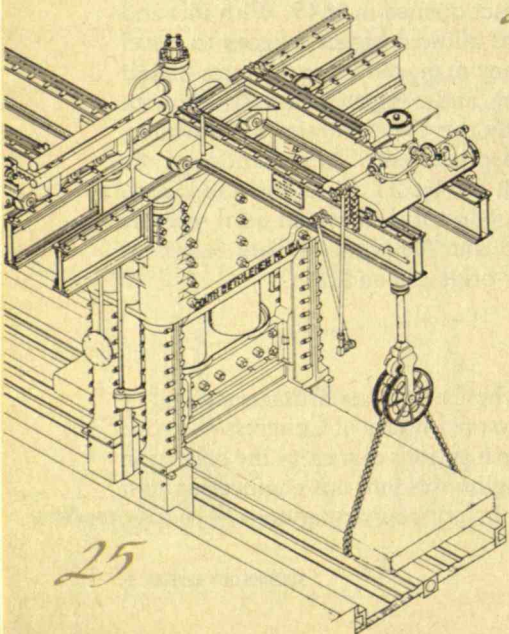
The Delaware Aqueduct opened in 1849. With this and other improvements that allowed bigger cargoes to travel faster, the D&H company managed to cut its rates in half (to about 50 cents a ton), and competed successfully with trains until the 1870s. By the 1890s, however, the owners themselves had diversified into rail. They abandoned the canal in 1898. Although the D&H could not stand up to progress, Roebling's aqueduct did. It served until recently as a highway toll bridge, and the National Park Service is now restoring it to near-original condition.

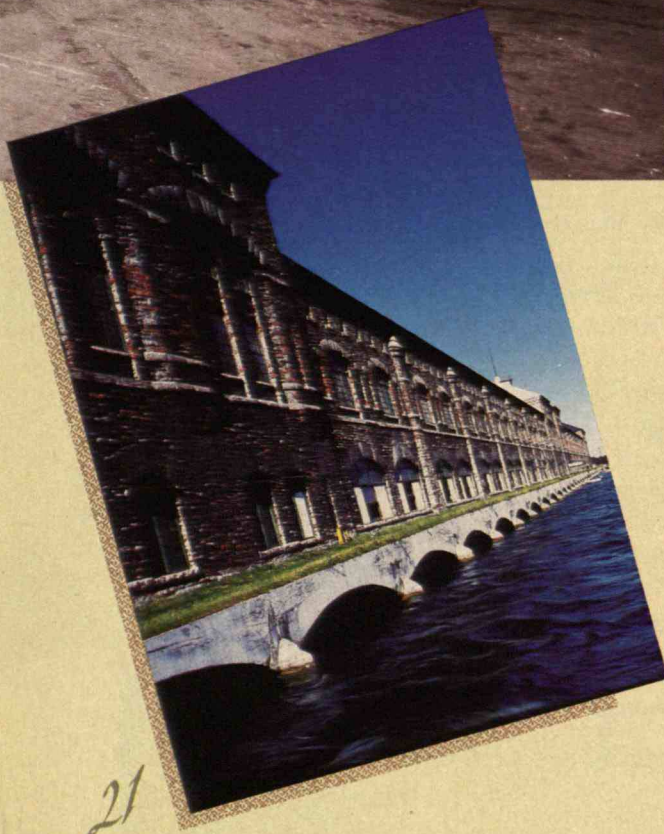
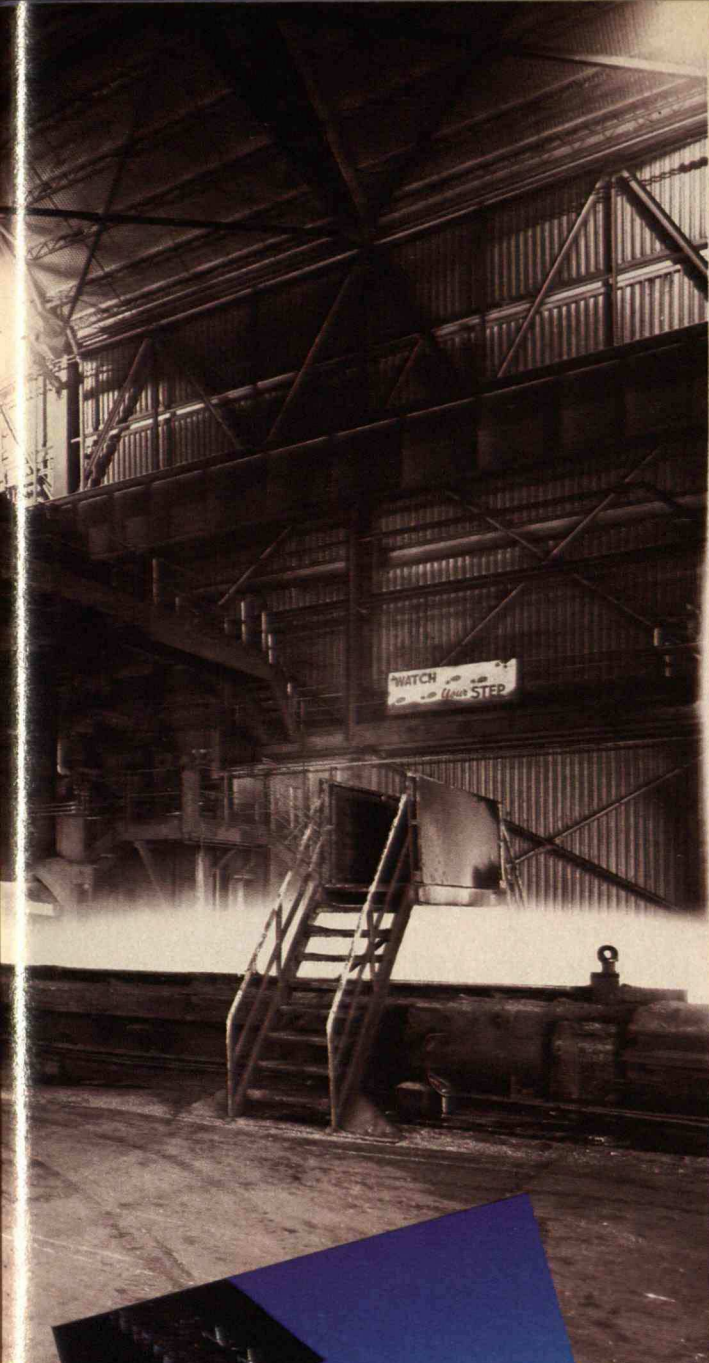
Packaging the Past

To get the full story on these and other artifacts studied by HAER, you have to go to the Library of Congress or to one of the 110 libraries and institutions that carry the collection on microfilm. But such glimpses into our engineering past are starting to multiply by popular demand.



(21) The hydroelectric plant of the Michigan Lake Superior Power Co., Sault Sainte Marie, Mich. It was completed in 1902. (22) A water turbine at the same plant, open for repair work on the blades. (23) Machinery still in use for cleaning steel slabs, LTV Steel Co., Cleveland. (24) The Gruber Wagon Works, Berks County, Pa., built in 1882. The works kept producing until long after the automobile had driven most other wagon makers out of business. Much of the original machinery is still in place. (25) A 12,000-ton press for forging armor plate at the U.S. Steel Homestead Works, Munball Borough, Pa. U.S. Steel bought the press from Bethlehem Steel in 1903 to meet the demands of the Navy's expansion program.





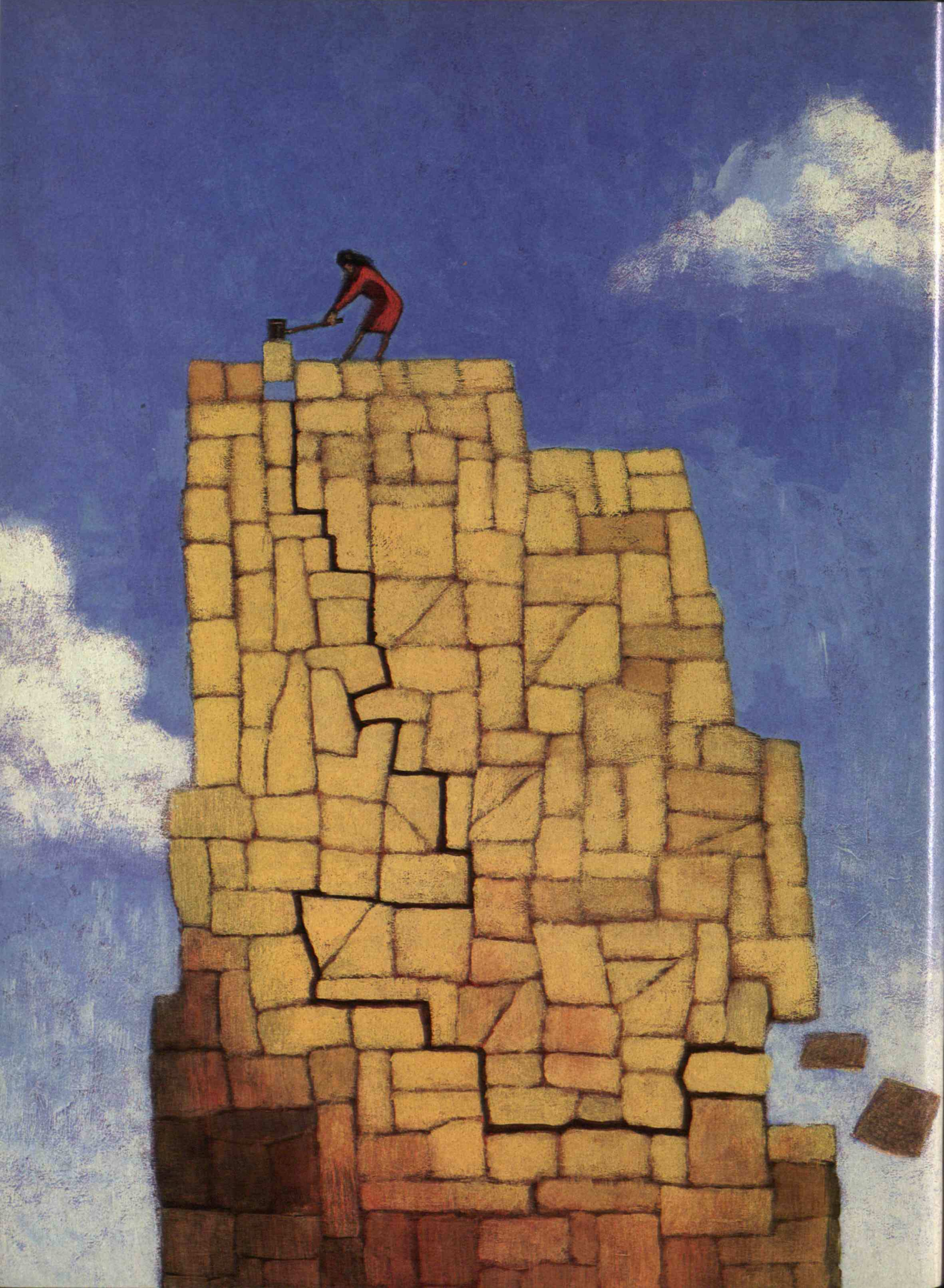
In an almost hydraulic way, the level of support for industrial history is rising as the fortunes of basic manufacturing fall. "In 1964, when I graduated from engineering school at Rutgers, factories were considered dirty," says HABS/HAER chief Kapsch. "But as we turn more to a service economy, people are interested in other people that actually make things and produce things." And in steel towns like Homestead and Johnstown, Pa., he says, "our experience is that people are interested in the history. All of a sudden, the industry that sustained the community is no longer there, and they want to know what happened. It's a real basic question."

This upsurge in interest makes industrial history a sought-after commodity. In 1980, Congress passed legislation that requires any federal agency involved in tearing down or altering a historic structure to commission a recording project for HABS/HAER. Congress has also appropriated extra funding over the past few years (\$480,000 in fiscal 1990) so HAER can document steel mills and other structures in Pennsylvania, and last year set aside \$600,000 for West Virginia University's Institute for the History of Technology and Industrial Archaeology. Engineering societies are getting in on the act, too, setting up formal history programs and hiring historians.

For the general public, though, the most important aspect of this trend—and perhaps HAER's most tangible contribution—is a new form of fun and adventure. HAER, through its regional surveys and recording projects, is helping the National Park Service identify interesting historic areas that could be turned into national parks based on industrial or transportation themes. The 10-year-old national park at Lowell, Mass., where visitors can immerse themselves in the history of the U.S. textile industry, is merely a foretaste. HAER chief Eric DeLony says that 21 traditional industrialized areas—"the Worcesters, the Pawtuckets, the Allentowns, the Bethlehems, the Pittsburghs, the Clevelands"—are candidates to become the new national parks of the 1990s and beyond.

One park already under development is America's Industrial Heritage Project, consisting of nine whole counties in southwestern Pennsylvania and based on the themes of iron and steel, railroading, and mining. Tourists will drop by visitor centers in places like Pittsburgh, Johnstown, or Altoona. There they will browse through exhibits, watch videos, and pick up materials for self-guided tours. "You'd be able to drive through the southwestern Pennsylvania countryside and stop off at old stone-base glass furnaces," says DeLony. "You could take a dip in a swimming hole, then stop in Johnstown and go to the Cambria Iron Works, where Bethlehem Steel is still rolling light structural sections. It would be a different type of tourism."

As for HAER's role in this enterprise, DeLony says: "What we can do best is articulate and define and illustrate those parts of America's industrial and engineering heritage that can be folded into this larger experience—of understanding what we did and why we're here, and having some sense of what the future holds." ■



Managerial Microworlds

*"Organizational learning"
could help U.S. managers reverse
their tendency to focus on immediate goals
at the expense of long-term strength.*

BY PETER M. SENGE AND COLLEEN LANNON

IF you were into saving money and had to fly somewhere, People Express Airlines was the way to go—at least for a while. With meals and baggage handling optional extras, a People Express flight wasn't fancy, but you could travel from New York to Miami for the price of a bus ticket.

Yet the spectacular growth of People Express, from start-up in 1981 to \$1 billion in revenue in less than four years, was matched by its dramatic downfall. In the first half of 1986, the company lost \$133 million. After Texas Air swallowed the airline in September of that year, many observers, including People Express CEO Donald Burr, pinned the airline's demise on the advent of computerized reservation systems and computerized load-management techniques. These made it possible for major carriers to offer a limited number of highly discounted seats that competed with People Express prices.

But a computer simulation developed by John Sterman, director of MIT's System Dynamics Group, suggests that a deeper set of forces was at work. Despite a growth strategy combining many innovative ideas that have since helped other companies thrive, People Express would have survived only a few more years, the simulation shows, even if competitors' prices remained higher. The core problems the firm faced weren't external. Instead, it was a victim of its own thinking: its strategic ideas, though brilliant individually, actually conflicted with one another. The pieces were right, but the whole failed.

Correct or not, the simulation points to a vital issue: How could the managers at People Express have discovered such a problem in time to save the company? For the past several years, a small group of innovative corporations has been working with MIT's Systems Thinking and Organizational Learning (ST&OL) program to address questions such as this. The business press often describes "organizational learning," one of the newest management buzzwords, as a way to help companies react faster to external changes. But being faster doesn't necessarily mean being smarter. What firms need are ways to recognize when their problems are of their own making.

At the heart of our research is a set of questions. Can people in organizations learn to think systemically—that is, to see interactions among strategic issues rather than looking only at isolated events? Do methods exist to tap people's intuitions about complex situations—insights that get lost in the day-to-day pressures to find immediate fixes? How do new ways of thinking spread in large organizations? And what skills and tools do managers need to continue learning about complex issues?

We are finding that managers can learn to think systemically if they can uncover the subtle interactions that thwart their efforts. This can best be done by creating "microworlds," a term coined by Seymour Papert, MIT media technology professor, to describe an interactive computerized environment that simulates a real-world situation. Managers can use microworlds to expose assumptions underlying their business strategies. Through computer-simulation models like the one Sterman developed to analyze People Express, microworlds could transform how organizations learn. And they may be a first step in reversing the chronic tendency of U.S. companies to focus on the short term and neglect the long term.

Total Quality: The First Wave

The first wave of organizational learning came with the "quality revolution" that, by ushering in the total quality (TQ) programs pioneered by Japanese firms, has shaken U.S. industry from its lethargy.

By providing updated feedback to decision makers on key variables like defect rates and delivery and

manufacturing times, TQ programs promote continuous improvement. The master stroke behind the approach is that managers and workers, once they have the tools to analyze and solve problems, become responsible for quality rather than delegating the job to outside "experts."

By relying on TQ programs, U.S. companies like Ford and Motorola have achieved world-class levels of quality. These companies' progress verifies that the rate at which organizations learn "may soon become the only sustainable competitive advantage," as Analog Devices CEO Ray Stata has said.

But the quality revolution is far from over. Although firms committed to TQ continue reporting improvements in manufacturing cycles and fewer production defects and late shipments, improvement rates are declining. Moreover, managers report that extending the total quality philosophy to issues removed from the production line, such as new product development, is difficult: TQ's trial-and-error process breaks down because of the long time delays. The cycle of organizational learning is like the development of a child who is advancing from building blocks to more complex situations like making friends with others.

Recreating People Express

Managerial microworlds take learning through doing into a new phase. Decision makers take control of a fictitious company, playing out the roles they fill in real life. But unlike the actual world, managers are free to experiment with policies and strategies without fear of jeopardizing the company. In the process, which includes the kind of reflection and inquiry for which there isn't time in the hectic everyday world, managers learn about the long-term, systemic consequences of their actions.

Such a "virtual world" is particularly important in team learning. Imagine a symphony orchestra that doesn't rehearse or a basketball team that doesn't practice. High levels of proficiency are impossible in teams without well-developed virtual worlds. Is it any surprise that management teams have had difficulty learning when they have lacked a meaningful analog to the music rehearsal or the team practice?

In a managerial microworld, a simulation model generates a company's behavior based on interactions in the organization and with its market and competitors. Consider the People Express example. Drawing on a Harvard Business School case study, John Sterman produced a microworld that incorporates key features of that firm:

■ Lower fares affect both established and new travelers.

PETER M. SENGE directs the Systems Thinking and Organizational Learning program of the MIT System Dynamics Group. His book, *The Fifth Discipline: The Art and Practice of the Learning Organization* (Doubleday) is due out next month. The book shows how microworlds and systemic thinking are part of a new set of disciplines changing the way organizations learn. COLLEEN LANNON, a freelance writer, edits a newsletter on the practical applications of systems thinking in companies.

■ Both advertising and word of mouth drive market growth.

■ Job rotation and self-managed teams create high employee productivity.

■ Employee productivity also depends on experience level, morale, turnover, and, since the employees are all given stock in the company, stock prices.

■ Flight availability, fares, service quality, and the range of services offered affect the number of passengers.

■ As People Express grows, competitors respond by lowering their own prices.

Teams of two or three players can explore the People Express microworld by drawing up their own growth strategy for the company. The teams make five decisions. Two are strategic choices—the average fare and scope of services to provide. The others are operating decisions made on a quarterly basis—the number of aircraft to add to the fleet, the number of hires, and the money to allocate to marketing.

The computer simulates what happens each quarter and presents a summary report. To chart the long-term consequences of its decisions, a team also has access to information on such matters as changing stock prices, employee morale, market research, and fleet size.

By experimenting, players can test hypotheses about why People Express failed. One scenario is to trace the actual company history by following Don Burr's operating strategy: keep prices deeply discounted, maintain no-frills service for travelers, expand the fleet and service staff about 100 percent a year, and market heavily. As the computer begins to simulate quarterly results, problems appear. The average workweek gradually rises to 60 hours, which makes turnover increase and the fraction of rookie employees skyrocket. Service quality erodes, and eventually the number of passengers drops off sharply, along with profits.

The results reveal an inherent inconsistency in the People Express strategy. Management attempted to build a high-commitment, flexible work force, yet it needed to double the number of service employees yearly. More time was required to train and assimilate People Express employees into the company's distinctive human-resource system than was possible given the rapid passenger growth. The result was deteriorating service that drove away many loyal customers. When business turned down, stock prices declined and morale and service quality fell even further.

Another revealing experiment is to test the theory that computerized load management caused the demise of People Express. Playing through a scenario that actually *eliminates* competitive price response shows that, for a few more years, People Express discount fares re-

THE
PEOPLE EXPRESS
MICROWORLD LETS
TEAMS TEST GROWTH
STRATEGIES AND LEARN
WHY THE ONCE
ENORMOUSLY
SUCCESSFUL AIRLINE
FAILED.



main very attractive to customers and the company continues to grow and profit. In the end, however, low prices cannot compensate for ever poorer customer service, and passengers begin to desert the company. People Express survives only a few more years, even while competitors' prices remain higher. The lesson is clear: by not sustaining service quality, People Express made itself vulnerable to competitor price cuts.

An Insurance Microworld

Three years ago at Hanover Insurance, a highly successful, medium-sized property and liability insurance company, the vice-president for claims and two other senior claims managers initiated a microworld experiment with ramifications broader than those in the People Express case. Like all its competitors, Hanover has been caught in a spiral of escalating settlement costs and premiums. Most insurance companies blame outside factors—lawyers, crooked body shops, and a “litigious society”—for this problem. After all, between 1979 and 1985 the number of product liability cases industrywide increased 150 percent. But the Hanover managers felt that internal practices were contributing to settlements that seemed to be significantly higher than what was fair.

Most experienced claims managers admit that the quality of their profession—which requires careful investigation, effective negotiation, and considerate and friendly service—is mediocre at best. What was once a true profession, where people developed expertise over many years, has become a halfway house for recent college graduates on their way toward more promising, high-profile careers in marketing and underwriting. Perhaps, the Hanover managers reasoned, deteriorating standards of quality were contributing to the increasing cost of settling claims.

But the managers had no direct way to test their intuition, because quality is difficult to measure. A claims department's effectiveness is calculated according to simple quantitative measures such as labor expenses and the number of claims settled each month. Therefore, the managers decided to examine the dynamics of hiring and training adjusters and to explore how those factors affect settlement costs and the quality of the adjusting process.

Working closely together over several months, the Hanover team and the ST&OL group began building a microworld by identifying both hard and soft variables vital to the claims-adjusting process. These consist of the numbers of claims pending and settled, the number and experience level of adjusters (known as adjuster capacity), the time required to investigate a claim,

B_y
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NIGHTMARE.



the money paid per claim, and investigation and negotiation quality standards. The group then established the relationships among these key variables. For example, as the experience of adjusters increases, the time needed to investigate a claim decreases. They incorporated these relationships into a computer model based on certain generic structures that we have come to recognize in a wide variety of organizations. The group continued to refine the model as their understanding of the interactions among the different parts of the system grew.

Eventually, simulations began to show how the firm could appear to have adequate adjuster capacity and yet actually suffer chronic undercapacity. Imagine that an adjuster receives a call concerning damage to a claimant's car. Because of a large backlog of cases, the adjuster takes no action for weeks. Then, to speed up matters, the adjuster assesses the damage over the telephone, solely on the testimony of the claimant, witnesses, and body shops. After asking the claimant what he or she thinks the damage is worth, the adjuster mails off a check for that amount. Although this response lets the adjuster settle a large number of cases, the absence of careful investigation and negotiation also often results in overpayment.

The team developing the microworld concluded that well-established practices throughout the insurance industry have led to massive underinvestment both in the number of adjusters and in their salaries and experience levels—thus increasing costs. Managers haven't seen the problem because adjusters keep hitting "production" targets in the number of claims settled. But as the quality of settlements has eroded, a vicious spiral has started: rising settlement costs have led to more attention to controlling expenses, which has led to further underinvestment in adjusters and further quality deterioration. By following commonly practiced policies, managers have unwittingly created their own worst nightmare.

Expanding the Learning Companywide

The managers who developed the microworld soon realized that they had to share their insights throughout Hanover, since decisions affecting adjuster capacity and quality are made throughout the organization. But our first attempts to expose other managers to the claims model backfired. We found that simply allowing participants to play with the simulation model resulted in their treating it as a game, not a learning tool. We therefore came up with the "claims learning lab," a three-day microworld that, in a compressed form, recreates the entire process that the original team of managers went through.

Hanover has used the claims learning lab for more than two years, and virtually all the company's claims managers have attended the sessions. Throughout the lab, managers are encouraged to question their beliefs. They debate about whether connections among certain variables are consistent with their experiences, and they eventually develop their own theories of claims operation. Then the participants develop strategies for improving long-term profitability and predict the outcomes. Finally, they test their hypotheses using the simulation model.

The most significant learning occurs as managers discover that their own decisions can create some of their most vexing problems. For example, one scenario we may give asks players to respond to an unexpected increase in new claims coming into their office. The managers' primary goal is to control production measures, remaining mindful of expenses. The managers have to decide how many adjusters to hire, how many cases they want to settle each month, and a target for the settlement size per claim. To the players' surprise, by the end of a four-year simulation the settlement size is as much as 20 percent higher than it was originally—even though the production measures are well in control. Once the participants begin to understand that settlement size goes up because of time pressures and eroding quality standards, they start to engage in lively discussions about whether myopia over monthly production targets occurs in real claims offices.

The managers' experiences during the workshop often surprise them. Much like someone confronting a gyroscope for the first time, they learn that reactions to pushes and pulls in the dynamic system of insurance adjusting are not obvious. Although many of their strategies fail, they start to understand the dynamics of the system in which they operate, and they emerge from the microworld with new confidence. They realize that they have greater leverage in improving matters than they had thought, and they recognize the enormous potential for improvement over the long run.

Patterns That Recur

We think microworlds have the potential to deepen and accelerate learning in a wide variety of management situations, and that their use could help unify management education. That's because microworlds are developed from a relatively small number of generic structures that we have seen recur in all kinds of business situations.

Evidence for these structures exists in several patterns of industry behavior. Many systems grow and then collapse, as People Express did. Many other systems, such

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as the real estate industry, oscillate, with profitability rising and falling. Still other systems, such as the insurance industry, show a gradual, almost unnoticed, drift to mediocrity.

The generic structures we have found most frequently, which we call "system archetypes," include:

■ *Limits to growth*, which operates whenever something—sales, employee morale, or acceptance of a new idea—grows for a while, then stops. For instance, at People Express and many other initially successful start-up companies, growth cannot be sustained because the company is unable to serve rising demand.

■ *Shifting the burden*, which occurs whenever remedies appear to improve a problem in the short term but actually shift attention away from fundamental corrections. Examples include trying to boost lagging profits by cutting costs rather than making product innovations; relying on a consultant to solve personnel problems instead of having managers develop their interpersonal skills; or, as in the case of the insurance adjusters, working faster instead of honing skills and hiring more adjusters to investigate and negotiate fair settlements.

■ *Eroding goals*, which is a special version of shifting the burden. In this case, managers lower standards to deflect attention from fundamental and perhaps difficult corrective actions. A service manager, for instance, might decide that satisfying customers is an unrealistic goal and instead opt for minimizing the formal complaints reported to the head office. People Express became caught in this archetype when the company reduced its customer-service standards from what were once the highest in the industry.

■ *Tragedy of the commons*—borrowing biologist Garrett Hardin's phrase—which occurs when local decision makers, acting in their own best interests, take actions that eventually undermine a common resource needed to support everyone's interests. Corporate examples abound. To decrease costs, a division may cut corners and provide poor customer service, thereby damaging the firm's reputation. Or a manager may disregard employees' interests, sowing the seeds for antagonistic union-management situations that penalize everyone.

When managers recognize that their company is caught in one or more of these patterns, they start to understand why previous experiences have been so frustrating. All too often, well-intentioned policies in complex systems produce a positive outcome initially, but later trigger a problem that may be more costly than the original gains. With the help of microworlds, organizations are discovering a new set of tools for gaining control of their destinies. ■

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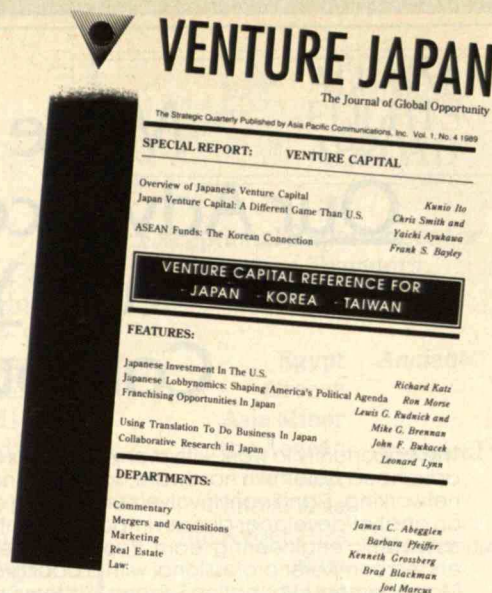
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Greater Engineering

ACCORDING to technology's reproachful critics, our technical genius has far outstripped our moral sensibility. We can go to the moon and explore the atom, so they say, but we've made precious little headway toward achieving a worthy society.

I have long thought this idea a half-truth at best. Indeed, I would argue that technological progress has brought moral progress in its wake. Throughout history, new technology has brought new wealth and comfort—first for the elite, then for society at large. As technology protects us ever more securely from the brute demands of nature, human nobility has a chance to evolve and flourish. Improved public health, longer life spans, and more widely available material comforts have permitted—in a way, evoked—higher levels of education, compassion, and democratic impulse. I believe this despite the frightful weapons and environmental peril that some technologies have produced.

I do not, however, find many people articulating this message of affirmation, least of all the technologists who should be its strongest champions. Corporations occasionally coin a superficial slogan: Du Pont promises better living through chemistry, and General Electric says its products bring good things to life. But with only Madison



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journalists see engineers as "wooden." Small wonder that people dismiss arguments on behalf of technology's humane influence. As an unfortunate side effect, bright, idealistic young people shun engineering for other careers, putting future progress at risk.

I was encouraged to see that the symposium commemorating the 25th anniversary of the National Academy of Engineering (NAE), held in Washington last October, was entitled "Engineering and Human Welfare." Striking the keynote motif, TRW founder Simon Ramo called for a "greater engineering" encompassing "more of the non-technological realm." Ramo, who once served as chief scientist in developing intercontinental ballistic missiles, spoke of the need "to harmonize technology with society" and of the obligation "to meet societal demands." He called upon engineering

Continued on page 78

Avenue to sing its praises, technology comes to signify the "goods life" (to use the term coined by the late Lewis Mumford) instead of the Good Life in the best sense.

Technologists have ceded the moral high ground. Distinguished engineers have failed to speak out about the social value of their work. Traditionally, when engineers speak publicly they stress the technical achievements of the past and call for improved technical proficiency in the future. Unlike prominent scientists, whom the public accepts as intellectuals and philosophers, technologists come across as taciturn and uncaring. According to a recent survey, most U.S.



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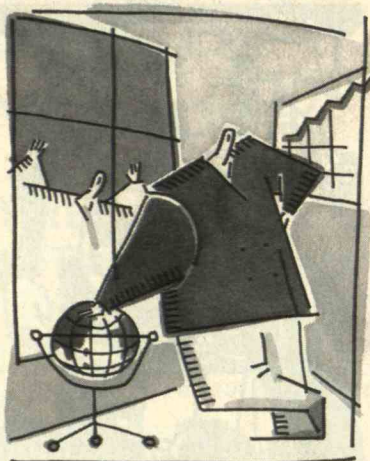
BENNETT HARRISON

Global Winners and Losers

BUSINESS around the world is undergoing a sea change. More and more companies are forming partnerships, especially across national borders. The companies that make up these strategic alliances are experimenting with flexible relationships with their employees and subcontractors: reducing the number of job classifications, assigning individual employees to a greater range of tasks, setting up joint labor-management problem-solving committees, and building complex relationships with one another and (sometimes) with their governments.

Many economists argue that these more flexible interorganizational arrangements will bring higher profits, increase global productivity and hence income, and permit workers to perform more interesting and creative work. But this description leaves out a lot. So far, only a small fraction of the world's workers and small businesses fully participate in this new networked business structure. In the worldwide production system taking shape in the 1990s, there are losers as well as winners.

Big companies in Japan, North America, and now Europe tend to create multi-tiered systems for managing labor and subcontractors. At the top of the hi-



*As the world economy
evolves into a giant network
of partnerships, lower-tier
companies and workers
will be left out
in the cold.*

erarchy are companies such as General Motors, General Electric, Motorola, Sears, Siemens, Fujitsu, and Olivetti. Their workers and managers enjoy secure employment with high pay and generous benefits. Analogously, the first-tier suppliers—Bendix in the U.S., for example, Bosch in Europe, and Nipponendo in Japan—receive longer-term contracts. Sometimes, these preferred suppliers also collaborate with the big companies on product design and engineering.

By contrast, lower-tier suppliers—and their suppliers—live a precarious existence. They feel constant pressure to upgrade their technology and the quality of their

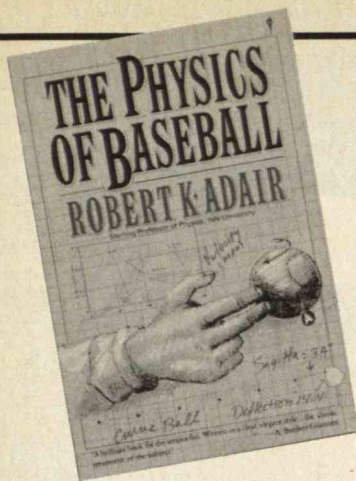
output, while holding their prices constant or even lowering them at a pace prescribed by their big customers. Big auto companies, for example, play off their lower-level subcontractors against each other, demanding quality that the smaller suppliers lack the knowledge or resources to deliver.

Whipsawed by the top firms and their first-tier contractors, these lower-tier suppliers offer little security to their workers. Pay is low, benefits almost nonexistent, and part-time and sporadic employment schedules are common. To make matters worse, the smallest suppliers are often located in regions and neighborhoods populated mainly by the poor and by immigrants—whether in the free trade zones of Thailand or the ghettos of Los Angeles.

When big companies form collaborative networks with their top subcontractors

BENNETT HARRISON, a professor in MIT's Department of Urban Studies and Planning, is currently a visiting professor at Carnegie-Mellon University in Pittsburgh. His most recent book, coauthored with Barry Bluestone, is *The Great U-Turn*, published by Basic Books.

Continued on page 78



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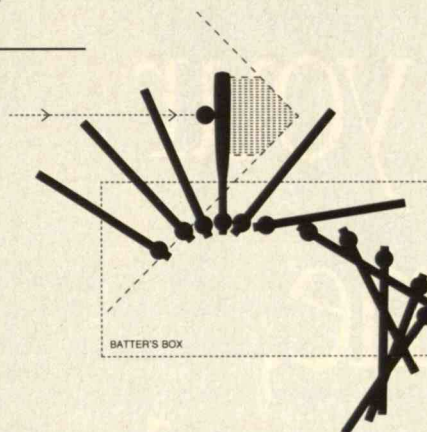
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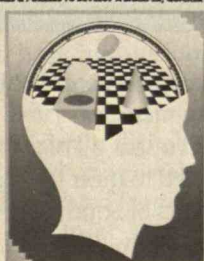
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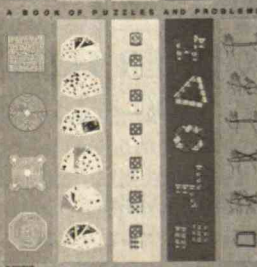
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Reviews

MUSIC

HIS COMPUTER'S VOICE

Vox-5

by Trevor Wishart

Computer Music Currents 4

Wergo CD: WER 2024-50

Idle Chatter

by Paul Lanksy

New Computer Music

Wergo CD: WER 2010-50

BY WILLIAM ELDRIDGE

ELECTRONIC music has come a long way since 1906, when Thaddeus Cahill demonstrated his Telharmonium in Holyoke, Mass. This 200-ton keyboard instrument synthesized tones with a set of dynamos driven by alternating current and was used for a time to pipe music into restaurants over telephone lines. Today, computers from microprocessors to mainframes have revolutionized the field, giving composers unprecedented control over every parameter of sound. Natural sounds can be digitally sampled and shaped, and completely original sounds can be created from scratch using a wide variety of synthesis techniques.

While digitally synthesized music now permeates our culture in popular music and scores for television and films, the music of serious composers working with computers is heard far less often. To the uninitiated, some of this music may seem abstract, strange, and lacking in human warmth. But approached with open ears, it can evoke new and unique aesthetic responses.

A natural bridge into this fascinating sound world is music that involves computerized speech and song. Voice synthesis, even if avoiding recognizable language, seems to endow the computer with life and sentience. Trevor Wishart's *Vox-5* and Paul Lanksy's *Idle Chatter* are intriguing recent works exploring



this domain. Both were composed using speech synthesis-by-analysis techniques developed from research done at Bell Telephone Laboratories in the 1950s, but they bend these similar technical means to vastly different artistic ends.

The works appear on compact discs in a recent series of computer music releases on the Wergo label. Other music on these two discs represents diverse compositional approaches, and either recording would serve as a good introduction to the field. Both CDs boast spectacular sound quality, sonically rich and spatially dynamic.

The Sound of Cosmic Unity

British composer Trevor Wishart created *Vox-5* in 1986 at IRCAM, the government-funded music research institute in Paris founded and directed by Pierre Boulez. In spirit and approach, the work harks back to the postwar *musique concrète* pioneered by Pierre Schaeffer, a French engineer who constructed sound pieces from recordings of birds, trains, and other aural souvenirs of the real world. Using such classic tape-manipulation techniques, one can interpolate and layer sounds, chop them into pieces, reverse them, filter them, and change their speed.

But computers allow other interesting possibilities. One of the most important is the ability to vary speed and pitch independently, permitting, say, a vowel sound to double in length without falling an octave in pitch, or a baritone voice to shift into the soprano range without speeding up the text beyond comprehensibility.

Equally important is the ability to analyze the spectral characteristics, or overtone structures, of two disparate sounds, then program the computer to make a smooth transition between them. The effect is quite different from that of the standard tape technique of cross-fading one sound into another. The first sound is literally transformed into the second.

This sort of transformation lies at the heart of *Vox-5*. Wishart used Mark Dolson's Phase Vocoder program to analyze a collection of sounds ranging from the human voice to bees and bells. Phase vocoding consists of splitting a sound into hundreds of narrow frequency bands and analyzing each band's amplitude and frequency characteristics. Using this information to control hundreds of electronic sound generators (one for each frequency band), composers can regenerate the original sound. More important, they can modify the sound by controlling individual harmonics, or overtones. By adding programs of his own, Wishart was able gradually to blend the overtones of two different sounds or "stretch" the overtones of a voice to give it a bell-like quality.

In *Vox-5*, such effects convey a metaphysical message. The work, as Wishart writes in the liner notes, "presents the image of a single 'super-voice' located at the front center stage, whose utterances metamorphose into natural events . . . poetic images of the creation and destruction of the world contained within one all-enveloping vocal utterance ('the voice of Shiva')."

The piece opens with a landscape of sounds from nature: a brisk wind portending a storm, perhaps merged with the sound of a faint surf. A flock of geese approaches from the distance and

flies overhead as the surf mutates into a burbling brook that varies subtly from treble to bass. As the flock recedes, the water warbles into recognizability as a human voice. The effect is somewhat like a movie camera's lens suddenly coming into focus to reveal an unexpected image.

The voice, beginning as a basso profundo and moving quickly into the high tenor range, has only enough time to articulate the syllable "buh"—perhaps the beginning of the word "buzz"—before being transformed into a swarm of bees. The piece progresses through a dreamlike series of such metamorphoses: naturally produced ululations and multiphonics (where a single voice produces several tones at once) reminiscent of Tibetan chant, a vocal sound manipulated to resemble a violin, and a voice that mutates smoothly into the

neighing of a horse. The end of the journey is reached with the patter of rain and a long, deep rumble of thunder.

With such a variety of sonic material, Wishart would seem to put artistic unity at risk. But the computer has allowed Wishart to impose (or reveal) unexpected connections and relationships between unlike sounds, perhaps making a philosophical statement about the cosmic unity of all things. Despite constant flux, the piece exhibits a sculptural sense of balance and proportion. And with its richness and unpredictability, the work reveals new surprises and connections on each hearing.

A Roomful of Auctioneers

If the Wishart composition can be thought of as a sort of sound collage, *Idle Chatter*, by Princeton composer Paul Lansky, is more readily recognizable as "music" in the traditional sense. With its infectious good cheer, simple tonal materials, steady pulse, and continuous texture, the piece seems more closely related to the minimalism of Steve Reich and John Adams than to the more austere and challenging music of Princeton legends Roger Sessions and Milton Babbitt. Dating from 1985, the work has become a classic of computer music.

All the sounds in *Idle Chatter* are derived from the spoken voice. Lansky's intent is not to transmute the voice into unrelated sounds but to transform speech into chant and song. He imbues the voice with musical pitches and rhythms while retaining certain characteristics of speech, such as the way consonants are articulated and vowel sounds change. The effect is unique and would be impossible to duplicate with live singers, who inevitably use a "singing" timbre and style of enunciation.

Idle Chatter employs a method of speech synthesis-by-analysis of which Lansky is a master: linear predictive coding. This technique involves taking a series of "snapshots," or frames, of a sound—in this case speech. Each frame contains information on the spectral content of the spoken sound at a given

instant. In synthesizing a voice, the composer uses these frames to control the filtering of a complex artificial sound such as a buzz tone, carving away all but the original spectra of the vocal source material. White noise is mixed in to form unvoiced consonants like *f* and *p*. The pitch of the buzz generator determines which notes the voice "sings," and the frame rate controls how fast the words are articulated.

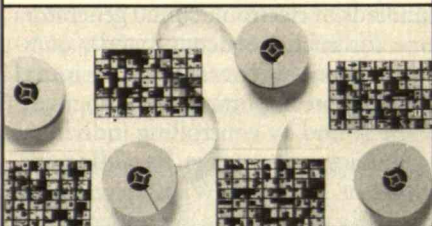
With the aid of automated composition programs, Lansky has scattered arbitrary syllables such as "duh," "daw," and "lillia" fairly evenly to create a rich pointillistic tapestry of many rhythmic layers and constantly shifting accents. The result calls to mind a roomful of auctioneers, all rattling away in their own rhythmic, syncopated monotones. In the background are long, swooping female choral lines that contrast with the brevity of the scattered syllables. To provide formal growth, the texture gradually gets more complex, the pitches become more varied, and keys suddenly change.

For all the sophistication of Lansky's technical means, the pitch content is quite simple and is derived from the familiar major scale. And underlying the many strands of rhythm is a clear sense of beat and meter. These elements combine with the slightly robotic timbre of the voices to produce a good-natured, smile-inducing ambience. Because of its simplicity and homogeneity, though, *Idle Chatter* may not stand up as well to repeated listening as *Vox-5*.

Both works are likely to strike listeners as more immediately accessible than those employing only abstract sounds. Just as a landscape becomes more interesting when it includes a human figure, the sound of the voice—the oldest musical instrument—provides a familiar point of reference in this new sonic universe. ■

WILLIAM ELDRIDGE received his PhD in music composition and theory from Harvard University and has composed numerous electronic and concert works. From 1985 to 1989 he served as teaching fellow for the Harvard Electronic Music Studios.

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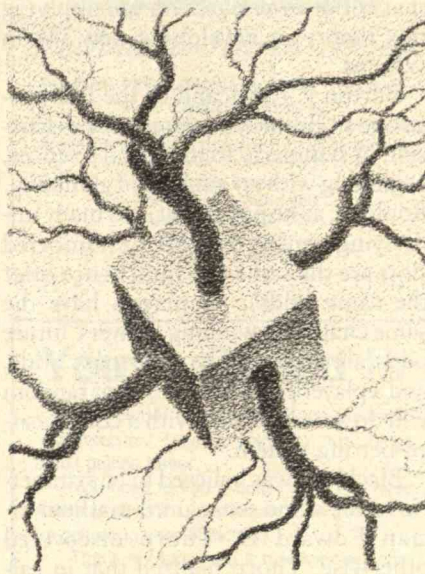
Symmetry 2: Unifying Human Understanding
Istvan Hargittai, ed.
Pergamon Press, \$110

BY ROGER F. MALINA

IN 1905 Albert Einstein elevated the simple concept of symmetry by making it the basis for much of his special theory of relativity. His ideas were so successful that symmetry became a pivotal concept in modern physics. When Princeton mathematician Hermann Weyl published his influential 1952 book *Symmetry*, detailing the idea's importance in both the sciences and the arts, the last word on this subject seemed to have been written. Since the early 1980s, however, theories about symmetry have been leading to discoveries in fields as diverse as crystallography and economics, proving that there is indeed something new to say. Several conferences have been held, and this year a journal called *Symmetry* has started up under the editorship of Hungarian chemist István Hargittai.

Hargittai is also the editor of a 1,000-page opus entitled *Symmetry 2: Unifying Human Understanding*, companion volume to a similar-sized book he published in 1986. Between them the two volumes involve authors in 23 countries, and cover topics ranging from physics and chemistry to dance, painting, and music. The second volume not only deepens the discussion presented in the first but extends the coverage to other areas, such as economics, robotics, and medicine. While some of the articles are highly technical, many are readily accessible to the nonexpert. Together they show that an age-old idea like symmetry can still generate new insights and discoveries, not only in the sciences but also in the arts and humanities.

What is symmetry? The book's open-



ing article, by Smith College mathematician Marjorie Senechal, provides an excellent overview. In essence, symmetry is the replication of a figure or object in such a way that its geometric properties are preserved. A mirror image, for example, preserves such properties while exchanging left-handedness for right-handedness. In other "symmetry operations," a figure may be rotated or simply duplicated ("displaced"). By repeating the steps of mirroring, rotation, and duplication in various combinations, one can obtain many different kinds of patterns starting with a simple figure—as any doodler knows. Mathematicians, in a branch of mathematics called group theory, have determined that repeating patterns produced this way on a flat surface fall into 17 basic groups. One of the simplest groups, for example, consists of repeating identical figures with no rotation or mirror imaging.

English scientist Roger Penrose writes about how such theoretical studies of symmetry can open researchers' eyes to natural forms they had previously overlooked. In the 1970s Penrose began studying "nonrepeating" symmetric patterns, which had been neglected since astronomer Johannes Kepler identified them in 1619. These are patterns whose elements appear to repeat on a small scale but actually undergo a

gradual change in size or alignment on a large scale. Penrose's research led him to conceive of a phenomenon known to be impossible for symmetric patterns that repeat indefinitely: a pentagonal pattern with five axes of symmetry (a simple mirror image contains just one axis of symmetry).

Crystallographers, who had assumed that crystalline structures were based only on *repeating* symmetric patterns, immediately started looking for signs that Penrose's fivefold symmetry could occur in nature. Crystals of Schechtmanite, a recently created aluminum and manganese alloy, display just such symmetry. And AT&T recently grew another of these "quasicrystals"—an alloy of aluminum, cobalt, and copper—whose electrical properties make it suitable for use in high-quality resistors and fuse links.

Astronomer H.W. Kroto describes another discovery that arose from symmetry theory. In 1985 he and his colleagues discovered a new superstable molecule in which each of 60 carbon atoms lies at the vertex of a truncated icosahedron—a regular symmetric spherical structure composed of five- and six-sided faces, like a soccer ball. They gave the molecule the fanciful name of Buckminsterfullerene, because it was Fuller's writings about geodesic domes—in which he discusses this structure—that inspired the researchers to hunt for truncated icosahedrons in the first place. The molecule has now been identified not only in the laboratory but also in common soot and in interstellar space. Although Buckminsterfullerene is not itself useful, its discovery has opened up a new class of material for exploration.

Symmetry in the Human Sphere

Symmetry also plays a key role in human perception. Psychologists Paul Locher of New Jersey's Montclair State College and Calvin Nodine of Temple University cite clinical experiments demonstrating that viewers can tell at a glance whether an object is symmetrical. Having detected symmetry, the

brain realizes that it would be redundant to scrutinize every element in an image. For example, you don't have to look at every window in a skyscraper to realize they are all the same size. Experiments that measure changes in skin conductance have confirmed that viewers become less aroused as more and more symmetric elements are introduced into an image.

Small wonder, then, that most painters carefully avoid strict symmetries in their work—or that decorative art through the ages has tended to be highly symmetrical (in fact, mathematician Branko Grunbaum has found 13 of the 17 known classes of repeating symmetric patterns in mosaics at the Alhambra in Granada, Spain). Discoveries about the way we see are introducing new hard data into the field of empirical aesthetics. Beyond merely proving what artists already know, they could eventually help artists create works of greater subtlety and impact.

Alfred H. Lowrey of the U.S. Naval Research Laboratory writes that such findings about symmetry's role in perception are proving useful in the field of

robotics. One thing humans can do that robots can't is quickly pick out a familiar face in a crowd. It is possible that the mind homes in on deviations from ideal symmetry that serve as clues in distinguishing faces. Lowrey writes that robotics researchers are applying this theory in developing new vision systems.

Burton P. Fabricand of the Pratt Institute in Brooklyn extends the discussion of symmetry to the social sciences, beginning with an analysis of gambling. Roulette, as he points out, has many underlying symmetries. All the numbered slots are the same size (and hence offer the same odds), all players have the same chance of winning, players' future odds are the same as their past odds, and a player picking numbers at random will do as well as one with a complicated betting system.

Blackjack was believed to be symmetric in the same sense until mathematician Edward O. Thorp discovered otherwise. Thorp realized that in calculating the odds, casino owners had assumed a constant deck of 52 cards without taking into account the diminution of the deck as the game progresses. He was then able to develop a strategy that allowed him to beat the house consistently, forcing casino owners to change the rules of blackjack. Fabricand points out that some casinos have since returned to the old rules of blackjack and hence should be vulnerable to attack by someone familiar with the symmetry violation.

Fabricand continues to analyze data from the stock market and commodity markets in search of similar kinds of symmetry violations. Mathematical analysis of the stock market reveals that, apart from symmetry violations caused by insider trading or using late-breaking information not known to all investors, the market is largely symmetric. For example, as Nobel Prize-winning economist Paul Samuelson has testified before Congress, picking stocks at random and investing in a mutual fund pay off equally over the long term. If Fabricand's quest for symmetry violations is successful, then the study of symmetry may prove profitable in more ways than intellectually. ■

ROGER F. MALINA is an astronomer at the University of California, Berkeley, and executive editor of the international art journal *Leonardo*.

educators to acquaint their students with the social, economic, and political systems that will influence how their developments will be used. Several other distinguished engineers, including White House Chief of Staff John Sununu, spoke in the same vein. It seemed like the launching of a crusade.

There will always be plenty of people to make gloomy comparisons between technological progress and moral improvement. But as I look at the progress made in civil rights, environmental preservation, safety in the workplace, and more, I conclude that our moral awareness has kept pace with our technical achievements.

Of course, technology only permits—not assures—virtuous behavior. The lapses and reverses of the last century, most notably two world wars and numerous environmental disasters, make that clear. At the NAE symposium, the engineering community seemed ready to take an important step—making moral progress a goal, not simply a byproduct. It is time for leaders of the engineering profession to step forward and assert the moral grandeur of their enterprise. ■

HARRISON/CONTINUED

tors, short-term productivity and profits rise. But these new alliances bring about a disturbing revival of stratification and hierarchy, with potentially serious consequences. By deliberately creating a low-wage tier of second-class suppliers, the world's core companies are holding global economic growth below its potential.

While business analysts like Tom Peters correctly describe the flattening of hierarchies *within* the top-tier companies, they miss the re-emergence of hierarchy at the level of the network as a whole—along with the implications for system-wide expansion.

In economics textbooks, the more enlightened firms drive the more shortsighted ones out of business. The real world doesn't work that neatly. Managed hierarchies may seem enlightened (and profitable) in the short run. But global re-industrialization is going to require a far more thoroughgoing commitment to collaborative manufacturing than most companies have been willing to risk so far. ■

TechnologyReview

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LETTERS/CONTINUED

that is not overtly racist, sexist, or otherwise offensive. The above ad did not strike us as qualifying for exclusion, but obviously that judgment is subjective. Also, we do not run cigarette ads.—Ed.

POLITICALLY REPRESSED ENGINEERS

According to "Glasnost and Engineering" by Langdon Winner (*TR February/March 1990*), "Engineers in this country have never faced political repression." How quick Mr. Winner is to rewrite McCarthy-era history.

Julius Rosenberg was an electrical engineer who was executed for allegedly giving the secret of the atomic bomb to the Soviet Union. The physicist J. Robert Oppenheimer was stripped of all security clearances because of guilt by association and second thoughts about having developed the bomb. While Andre Sakharov, father of the Soviet bomb, suffered many indignities, he died a natural death; Oppenheimer, on the other hand, killed himself.

I wonder how many engineers who work for Defense Department contractors have been harassed by the Defense Investigative Agency for political reasons.

KIM O'BRIEN
Willimantic, Conn.

CORRECTIONS

"The Wrong Signals" by Bennett Harrison (*TR January 1990*) reports that "300,000 fewer college-educated black men earned \$36,000 or more than earned the equivalent in 1979." It goes on to say that "the number of black women with the same amount of schooling who earned this much did grow during this period, but only by 15,000." Those figures should have been 30,000 for black men and 1,500 for black women.

"U.S. Engineering Shortages and Foreign Students" by Steve Nadis (*TR April 1990*) incorrectly states that 55 percent of the nation's assistant professors younger than 35 are not U.S. citizens. According to Dorothy Zinberg of Harvard's Kennedy School of Government, 55 percent of *engineering* assistant professors under 35 are foreign citizens.

Classifieds



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Notes



1 Million Flies

University of California, Davis, entomologist James Carey is charting the life span of 1 million fruit flies. The data should help researchers determine whether built-in limits exist on the human life span.

Carey studies fruit flies because they are cheap, require little space, and have relatively brief lives. At a facility in Tapachula, Mexico, researchers will place 25,000 fly pupae into individual condiment cups every three weeks and allow them to mature and die naturally. The project is part of the "oldest-old mortality" study coordinated by the University of Minnesota's Center for Population Analysis and Policy.

Toy Test

A game developed by Tufts University engineer Van Toi Vo can help reveal the social skills and spontaneous learning abilities of disabled children. Vo collaborated with two Tufts undergraduates to design a wood-and-plexiglass prototype that tests the capacity of five-year-olds to reason sequentially, understand cause and effect, and concentrate on a task.

A child must operate four switches to direct a marble through a maze. One button

runs an elevator that raises a marble a foot. Another drops the marble into a chute and deposits it in a funnel above a cart. Working other buttons drops the marble and returns it to the elevator.

Vo has asked students to create more such devices and to find out if they could be sold commercially. He notes the lack of toys designed for handicapped children.

Earthquakes and Oil

Gas and oil extraction cause small but potentially dangerous earthquakes, according to a mathematical model designed by Stanford University geophysicist Paul Segall. He thinks that could explain the more than 1,000 tremors that University of Grenoble seismologist Jean-Robert Grasso has observed above one of France's largest gas-producing reservoirs. "When gas or oil that has been sitting in the pores of the rock is taken out, the gas reservoir shrinks but the surrounding rocks do not," Segall explains. "That sets up stresses in the earth."

Segall cites North American cases of extraction quakes in Texas, Canada, and southern California. He adds that extraction may have triggered a magnitude 7 quake in the Soviet Union, but the data "is pretty sketchy and it wouldn't convince a skeptic." In France, the company that operates the gas field Grasso observed didn't want the seismologist "to publish his results for fear they would alarm local residents," Segall says.

Contraceptive Lag

U.S. contraceptives "leave major gaps in the ability of people to control fertility safely, effectively, and in culturally acceptable ways," charges a report by a joint Institute of

Medicine/National Research Council committee. *Developing New Contraceptives: Obstacles and Opportunities* suggests that the regulatory and legal climate surrounding these devices discourages most pharmaceutical firms.

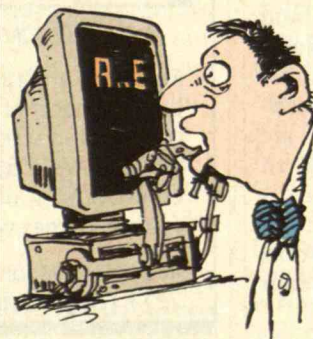
By contrast, many contraceptives in Europe are easier to use, fail less often, and last longer. In particular, methods available here poorly serve men, older women, teenagers, and women who are breastfeeding. That's part of the reason why 1 to 3 million unwanted pregnancies occur each year in the United States.

Read My Lips

Like Hal in 2001, real-life computers may soon read lips. Johns Hopkins electrical engineering grad student Ben Yuhas believes this could yield better speech-recognition devices.

"Speech recognizers currently available perform poorly when there's a lot of background noise," Yuhas explains. This cuts down on applications in factories or airplanes. But people who experience noisy distractions watch faces and lip-read to help themselves hear.

From a video laser disc, Yuhas takes frames of a person's mouth pronouncing vowels—that's how the computer "sees." He trains the computer to guess the vowel, based on the shape of the mouth and the position of the lips, teeth, and tongue.



Sound Cooking Advice

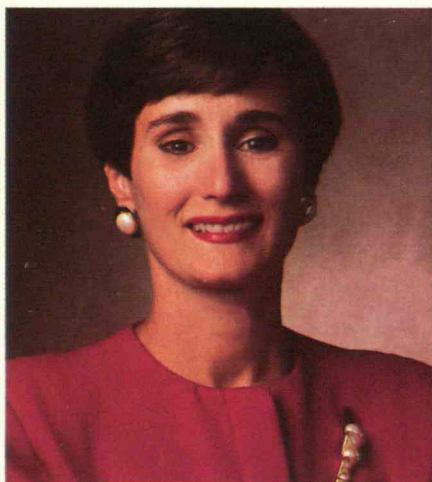
Devices that amplify acoustic emissions (AEs) can "listen" to the steam from frying potatoes and announce when the chips are ready, claims James Navratil of the University of New South Wales in Australia. He believes the food industry could apply that idea to further automate cooking.

Acoustic emissions are sounds—usually beyond the range of human ears—that materials generate under stress. One audible example is the creak of a tree branch about to break. AE techniques reveal stress in metals, glass fibers, and other materials. Navratil and his colleagues have shown that some chemical reactions, including sugar crystalizing, alcohol fermenting, and potatoes frying in oil, yield characteristic AE signals.

And 10 Million Chemicals

Synthesized by two Japanese researchers at Kyushu University, cis-(+)-4,6,7,8,8a,8b-hexahydro-6,6,8b-trimethyl-3H-naphtho[1,8-bc]furan is the 10-millionth substance in the American Chemical Society's computer-based registry of substances. The registry contains information on all new chemicals reported in the world since 1957.

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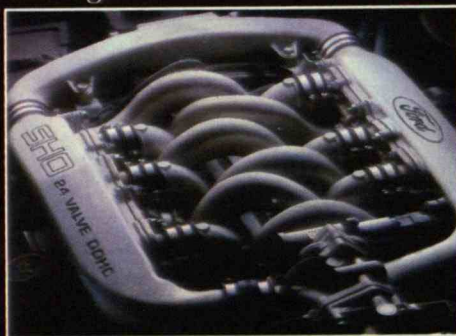
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